Heating Piping & Air Conditioning

AUGUST 1958

Single copy price 75c

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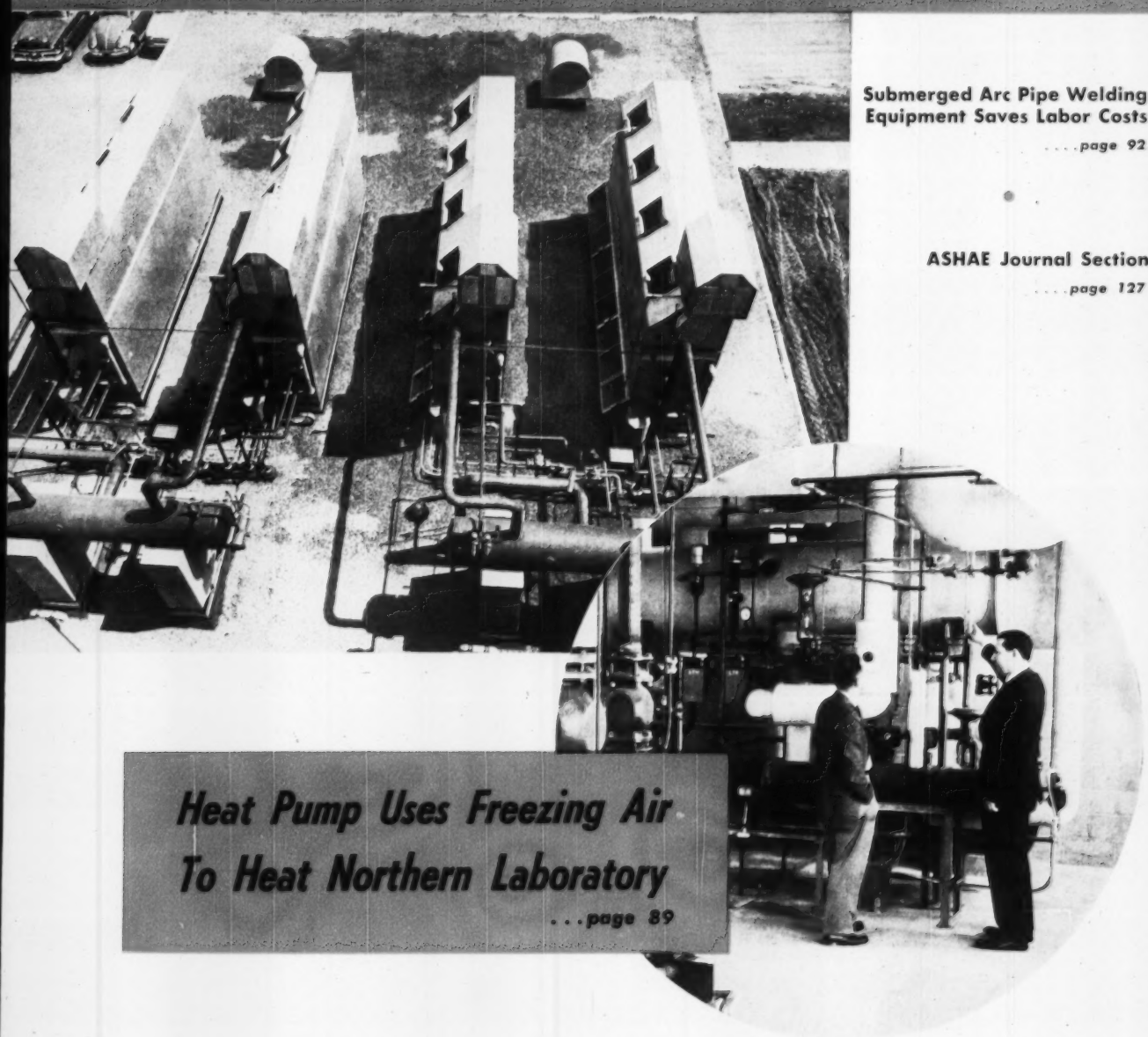

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ONLY YORK FAN COIL UNITS GIVE YOU A

Choice of all 3!

Twenty powerful, packaged models—the longest line-up in the industry—save space, installation and maintenance costs!

Only *one* manufacturer—only *York* offers floor, ceiling or exclusive wall-mounted fan coil units that begin saving you money the instant they arrive at the site!

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So, before you specify just *any* fan coil unit, make it a point to check all the money saving benefits of the complete York line with your local York sales representative.

You'll find him listed in the yellow pages of your classified telephone book. Or, write York Corporation, York, Pennsylvania, for Catalog EM-216!

YORK
CORPORATION
SUBSIDIARY OF BORG-WARNER CORPORATION
IN CANADA—SHIPLEY COMPANY OF CANADA, LIMITED

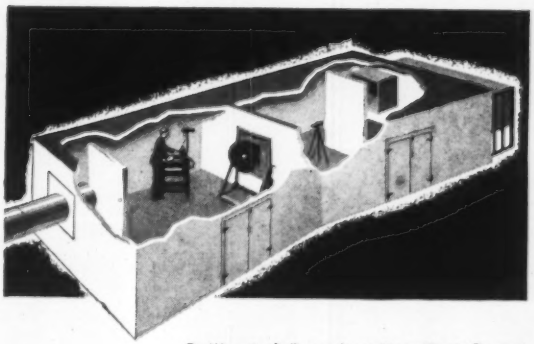
Millions Live Better with YORK...
the quality name in air conditioning

Manufacturers of Residential and Commercial Heating and Cooling Systems • Air Conditioning and Refrigeration Equipment for Industrial and Commercial Installations • Room Air Conditioners • Ice Makers • Refrigeration Units and Systems

DON'T GROPE...

for factual fan sound power ratings

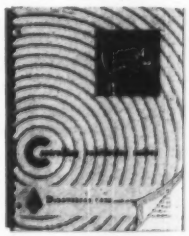
COMPARISONS AND PAPERWORK can't provide the kind of data you need on the sound power output of fans. That's why DeBothezat built and equipped these modern testing facilities. These special facilities and equipment are used to log the sound power output of every DeBothezat fan, on *both* inlet and outlet sides.



Calibrated Reverberation Test Rooms
Cutaway view of DeBothezat's noise evaluation reverberation test rooms, designed and calibrated by the acoustics staff of Armour Research Foundation.

Ratings on all DeBothezat fan units, measured as a complete assembly, are stated in both microwatts sound power and decibel sound pressure level in each of 8 octave bands of frequencies, measured separately. Next time you specify or install fans, ask your DeBothezat Sales Engineer for full information on the specific units considered.

"Controlling Ventilation Noises"
$2 PREPAID
when requested on your business letterhead



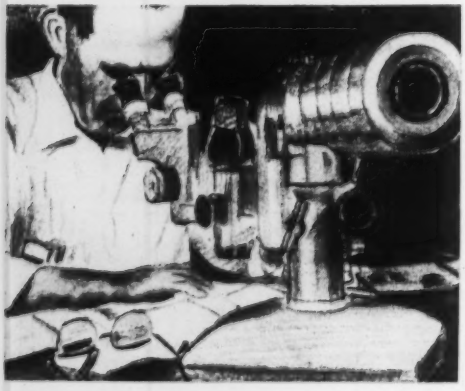
De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
Dept. HP-858, EAST MOLINE, ILLINOIS

IN CANADA: Represented by DOUGLAS ENGINEERING CO., Ltd., Toronto • Montreal

A Byers field service representative can relate new 4-D Wrought Iron test results to the specifier's corrosive applications.

Laboratory and field test results lend added support to 4-D Wrought Iron specs

Our metallurgical staff compiles and analyzes great funds of data on corrosion-resistant materials.



With some products, a company representative's natural enthusiasm is often *tempered* by actual test results in the laboratory.

Not so however, with new 4-D Wrought Iron. Byers field service engineers can present research facts which confirm the increased corrosion-resistance of this new product.

Comparative testing with standard Wrought Iron, as well as many ferrous substitutes, proves new 4-D Wrought Iron a decidedly superior deterrent to corrosion. So the wisdom of standard Wrought Iron specifications may now be further enhanced by specifying new 4-D Wrought Iron.

Byers field service engineers are lending even more credibility to this story with their own knowledge of corrosive infighting. The Byers representative will welcome an opportunity to relate these test results to your corrosive applications. Call him soon. Or, write us for helpful literature on new 4-D Wrought Iron. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

BYERS WROUGHT IRON

Heating Piping & Air Conditioning

Vol. 30, No. 8

(With which is merged the Aerologist)

for CONSULTING ENGINEERS, MECHANICAL (heating, piping, and air conditioning) CONTRACTORS, and ENGINEERS WITH PLANTS AND BIG BUILDINGS

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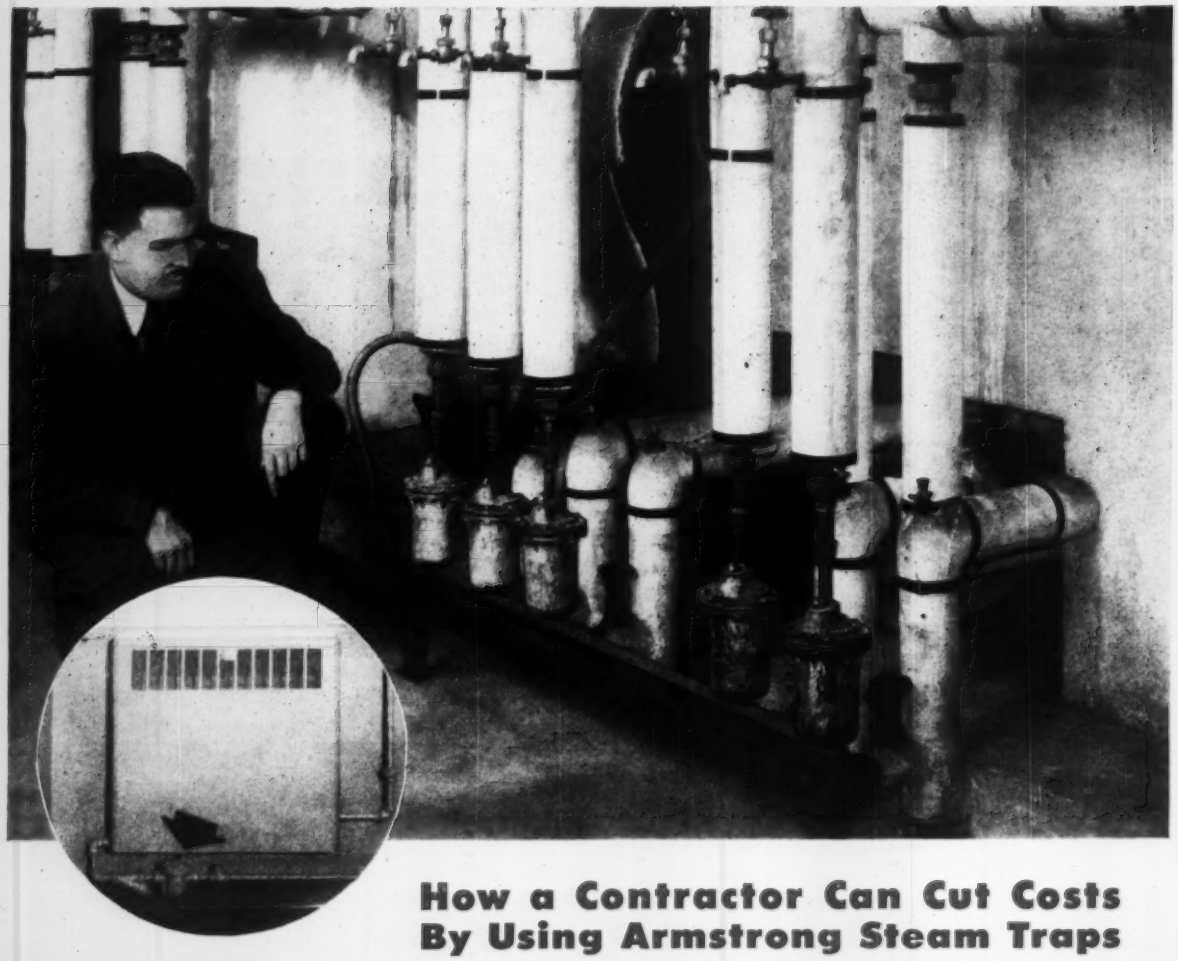


How a Contractor Can Cut Costs By Using Armstrong Steam Traps

● There is more than meets the eye in steam traps. If you don't regularly specify Armstrongs, you ought to know about these cost factors:

1. First Cost. The size and, hence, price of a trap is determined by its capacity. The high capacity of each Armstrong trap often enables you to select a size smaller than you would otherwise use.

2. Installation Cost.

Connections. Armstrong offers you a choice of straight-through horizontal or vertical connections, as well as a right angle trap, to save fittings and labor.

Strainers—seldom needed because ordinary dirt and scale won't plug up an Armstrong. When strainers are desirable, Armstrong offers built-in strainer traps that cost less to buy and install than separate traps and strainers.

Check Valves. Here again, Armstrong offers a cost saving with a stainless steel, spring loaded internal check valve that is superior to external check valves.

3. Call-Back Cost. When you put in Armstrong traps, the job is done. The traps will work without attention, not just for a month or two or even a year, but *more commonly 3 or 4 or 5 years!* No traps have so enviable a record for low maintenance as Armstrongs because the mechanisms in low pressure traps are identical in design, workmanship and materials to those used in traps for 900 lbs. pressure, 900°F temperature.

Get the figures and the facts. Call your local factory-trained Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
8748 Maple Street,
Three Rivers, Michigan

How to Select and Install Steam Traps for Lowest Cost:

Here are two pieces of useful literature you should have—free on request:

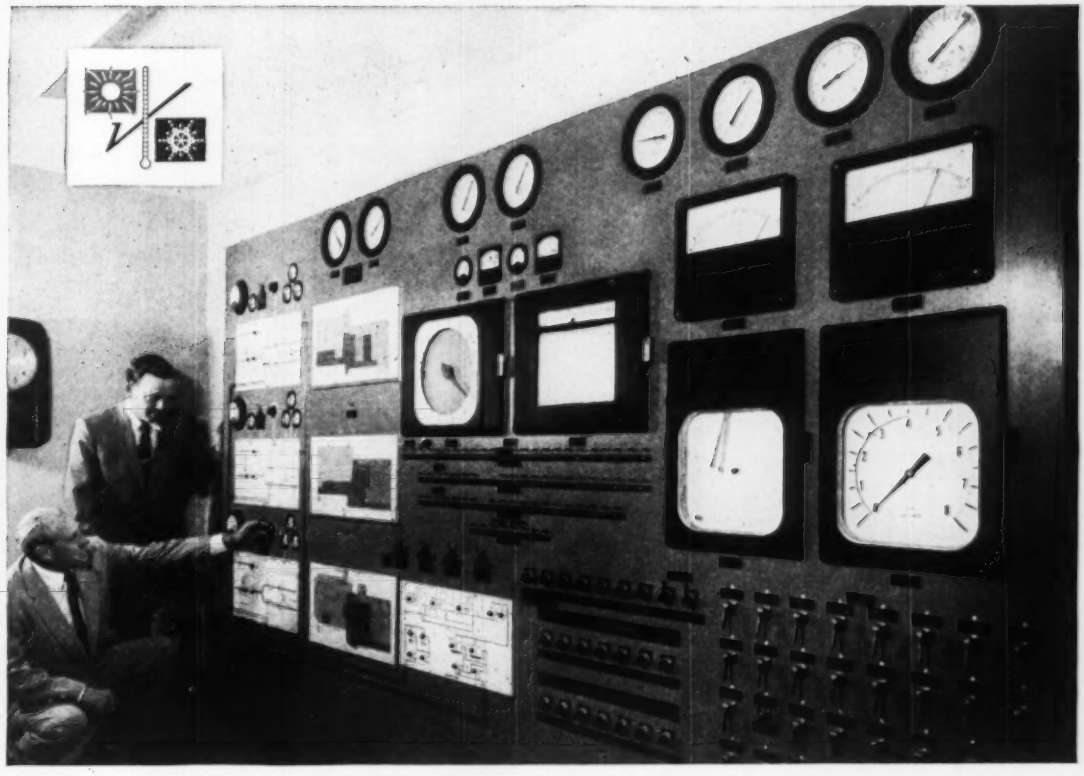
1. Armstrong Steam Trap Book—44 pages of trap data, tables, hookup diagrams and selection information.

2. Unit Heater Trapping—trap selection and installation plus BTU output tables for every model of 30 makes of unit heaters.

UNCONDITIONALLY GUARANTEED TO SATISFY THE USER

APPLICATION ENGINEERED

ARMSTRONG STEAM TRAPS



Centralized Control of Air Conditioning Saves Manpower, Assures Ideal Working Environment

North American Aviation, Inc., Los Angeles, California. Austin, Field & Fry, AIA, architects and engineers; Wm. Simpson Construction Co., general contractor; Western Air & Refrigeration Co., air conditioning contractor; all of Los Angeles.

Manpower savings of at least three men per day, reduced fuel and power consumption, longer equipment life and 24-hour-a-day comfort are made possible by this Johnson Control Center at North American Aviation's busy new headquarters!

From the Center, *one man* operates all the basic heating, cooling and air handling components of a modern high pressure, double duct air conditioning system.

To aid him, all vital operating data needed to keep the system functioning at peak efficiency are transmitted to the panel from remote locations throughout the windowless, three-story building. Simply by scanning the panel or pushing a button, the engineer can check fan operations, temperatures, pressures and related data from well over 100 key control points!

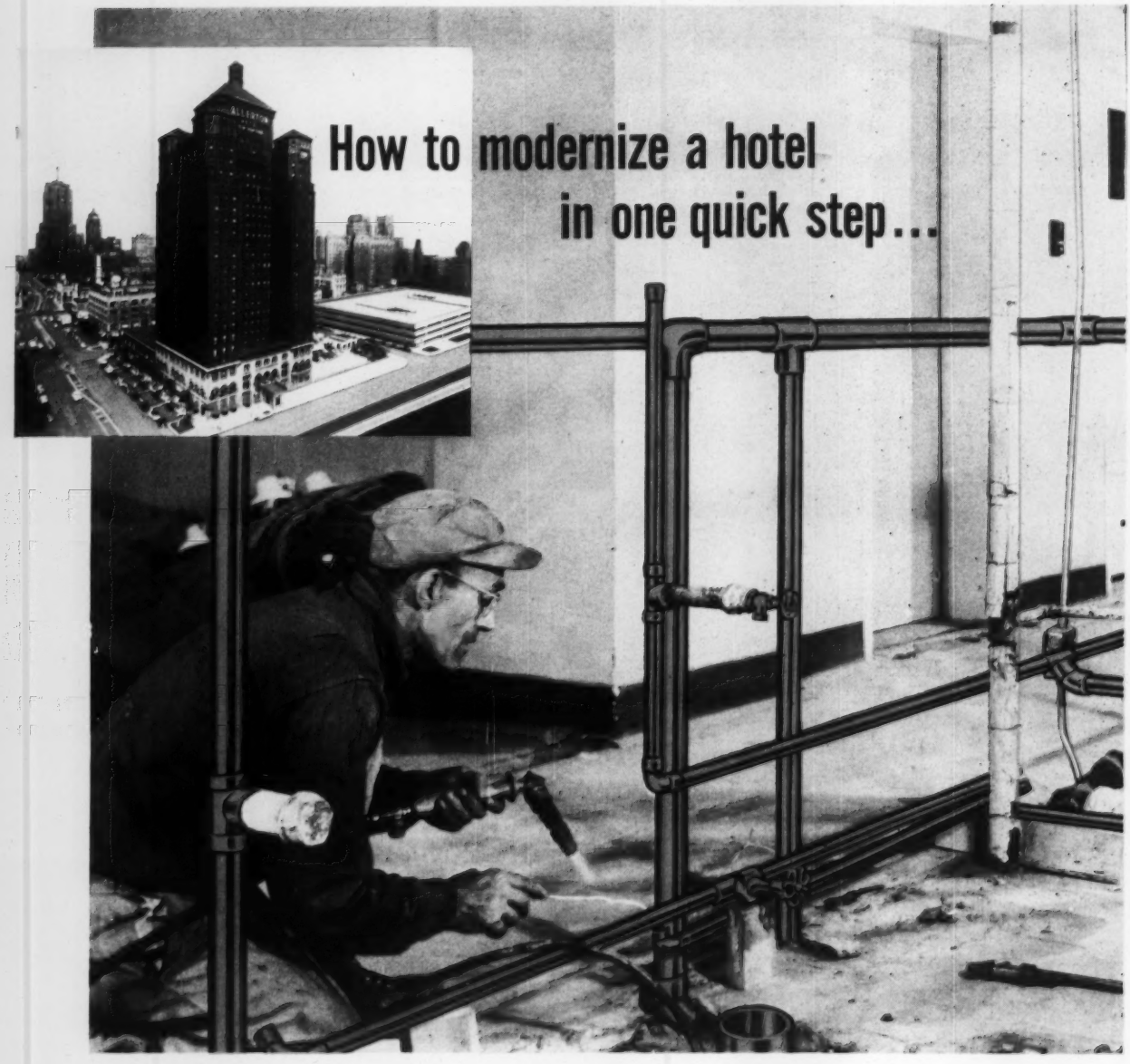
Johnson Control Centers are applied to buildings of all types and sizes. They assure your clients of the very best, most productive working environment that air conditioning can produce. And the owner quickly gets his investment back through major savings in operating costs and manpower. Your local Johnson branch has all the facts. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

TEMPERATURE CONTROL SYSTEMS FOR SCHOOLS, OFFICES, FACTORIES, STORES, HOSPITALS, HOTELS, PUBLIC BUILDINGS



How to modernize a hotel in one quick step...

ALLERTON HOTEL, CHICAGO
Gets Up-To-Date Guest Rooms by Installing New Plumbing System of Chase Copper Tube

Heart of the re-building program that is modernizing Chicago's Allerton Hotel is the improvement of guest facilities. Rooms will be larger, more comfortable and ultra-modern. As part of the job, Lake Shore Plumbing Company is installing a complete new plumbing system that will give each room its own facilities.

This new system is being built around Chase Copper tube and fittings for water and drainage lines —all supplied by Republic Plumbing and Heating Supply Co. Because Chase Copper tube is easier to pre-assemble, easier to handle, and because joints are made quicker and easier, there's far less disruption of hotel service during the job. And when the total cost is figured—tube, fittings and time—the overall job *will cost less* than using rustable pipe!

The next job you figure, plan on using Chase Copper tube. It never rusts, won't clog, and gives you appreciable savings at every stage of the job. Ask your Chase Wholesaler for details. And for every plumbing job, insist on LIFELINES® of Chase Copper Tube. You'll find it pays to use the best.

The Nation's Headquarters for Brass, Copper and Stainless Steel

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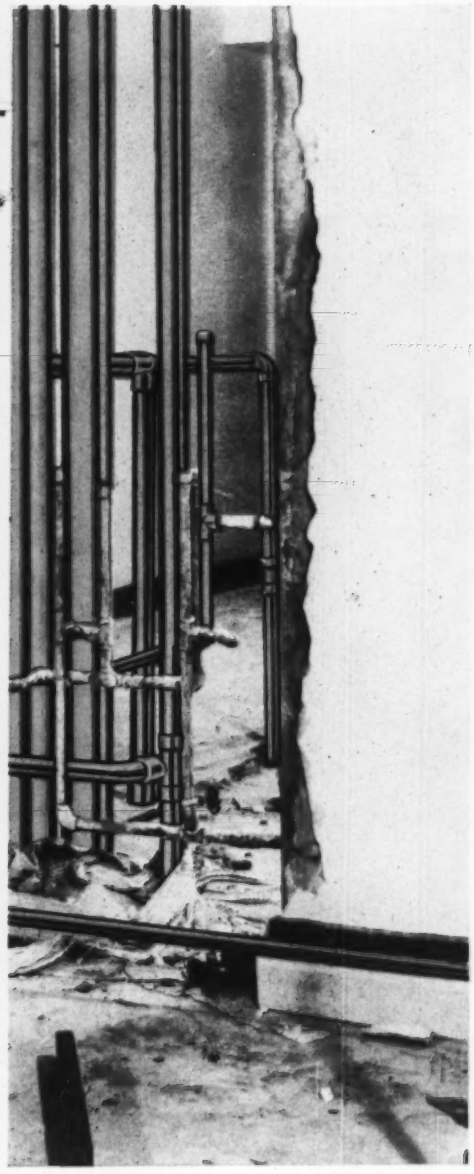


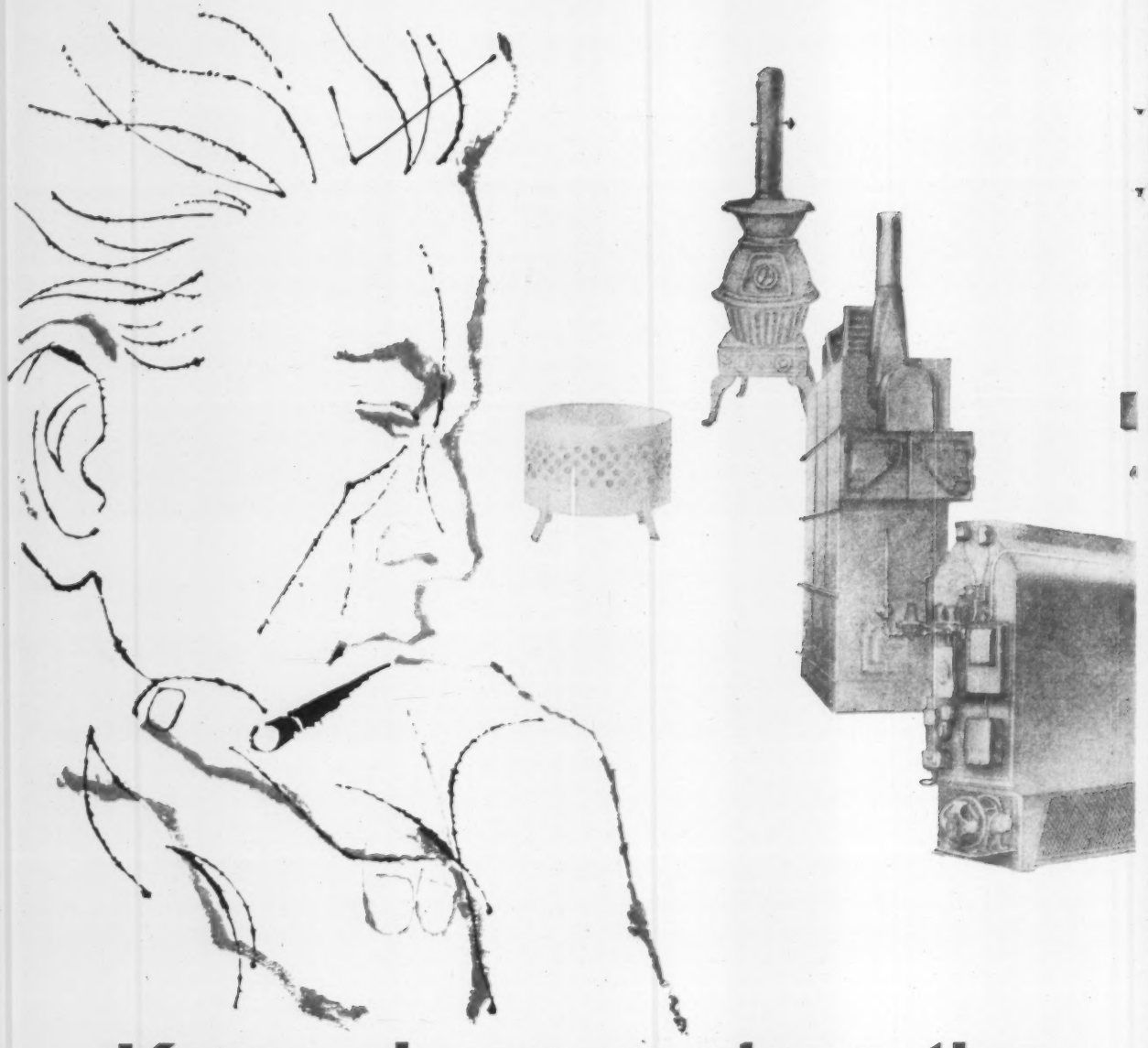
Typical run of Chase Copper water tube in the Allerton Hotel. Note the neatness of solder-joint connections.

Running a water line is quick, easy and fool-proof when worker uses copper tee fittings and copper water tube connected by quickly-made solder joints.

Job Foreman gives his OK to a neat, trouble-free solder joint made with Chase fittings as part of main drainage line.

Chase

BRASS & COPPER CO.
WATERBURY 20, CONN.
Subsidiary of
Kennecott Copper Corporation



Know-how makes the

IN HEATER APPLICATION

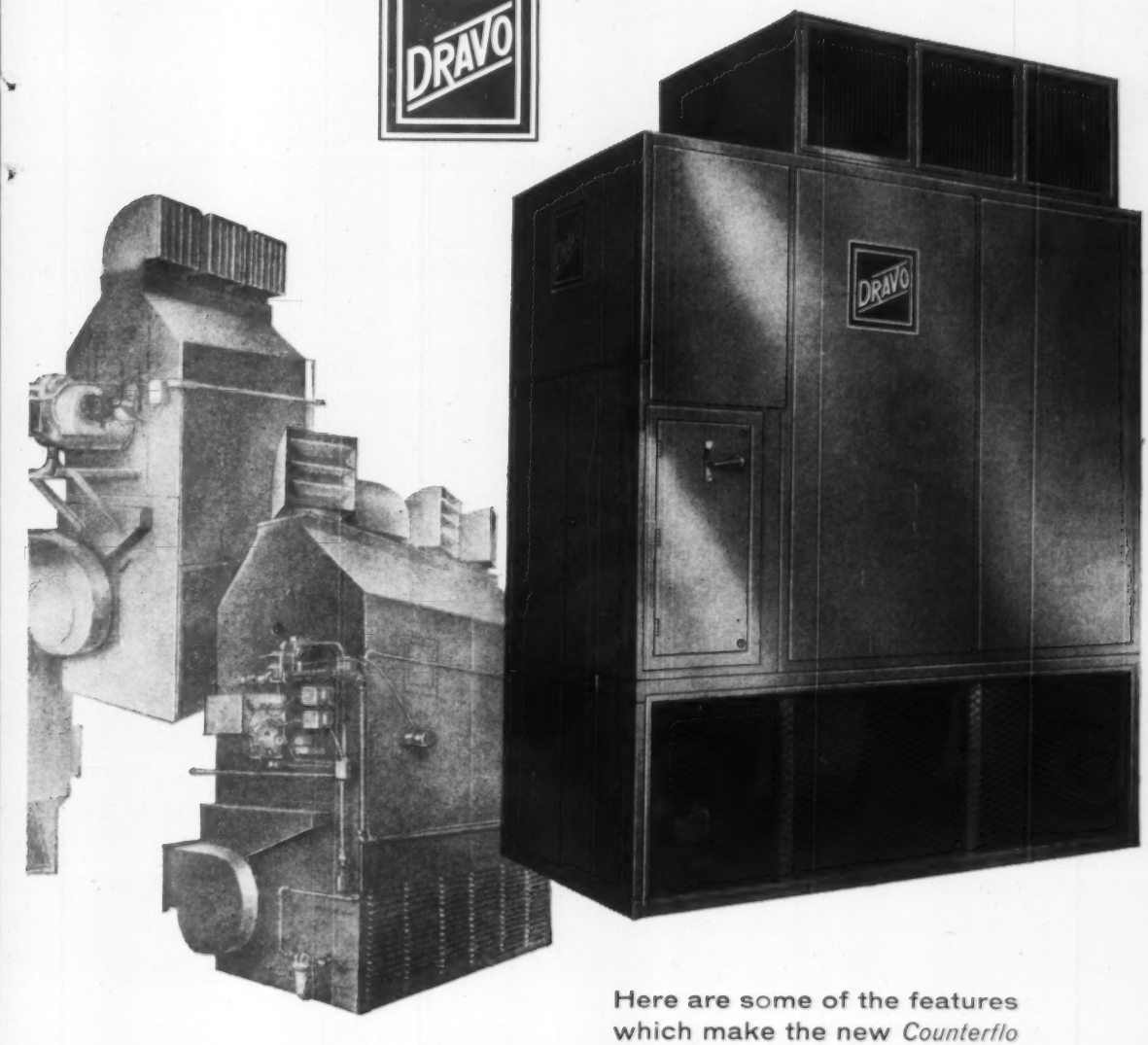
The new Dravo *Counterflo* has performance built in . . . the kind of performance possible only in a heater in which every part has been designed and built to function as an integrated unit. But it is the skill with which this performance is applied to the solution of a specific heating problem that makes it completely effective.

This is the important "extra" that every Dravo Heater customer gets. *Every* Dravo technical representative *is a qualified heating engineer* skilled at solving all kinds of heating problems in all types of industrial and commercial buildings.

Every man is competent to make a complete heating survey of your installation, working in cooperation with your engineering departments or consultant.

Every man is backed by the home office staff, who can bring both laboratory facilities and the total experience of over 10,000 installations to bear on unusual problems.

Get the benefit of this Dravo "extra" when *you* have a heating problem.



difference

IN HEATER DESIGN

The new Dravo *Counterflo* heater, developed by an exhaustive research program, represents an important advance in warm air space heating. Its "unitized" design, making each part integrate smoothly with the functioning of the rest, and the fact that each part was designed specifically for its function, makes the new *Counterflo* unique.

DRAVO
CORPORATION

Here are some of the features which make the new *Counterflo* heater your best heating buy:

NEW PYROJET BURNER—exclusively Dravo—first burner developed specifically for direct-fired space heaters. Burns low cost oils efficiently. Switches from gas to light oil automatically.

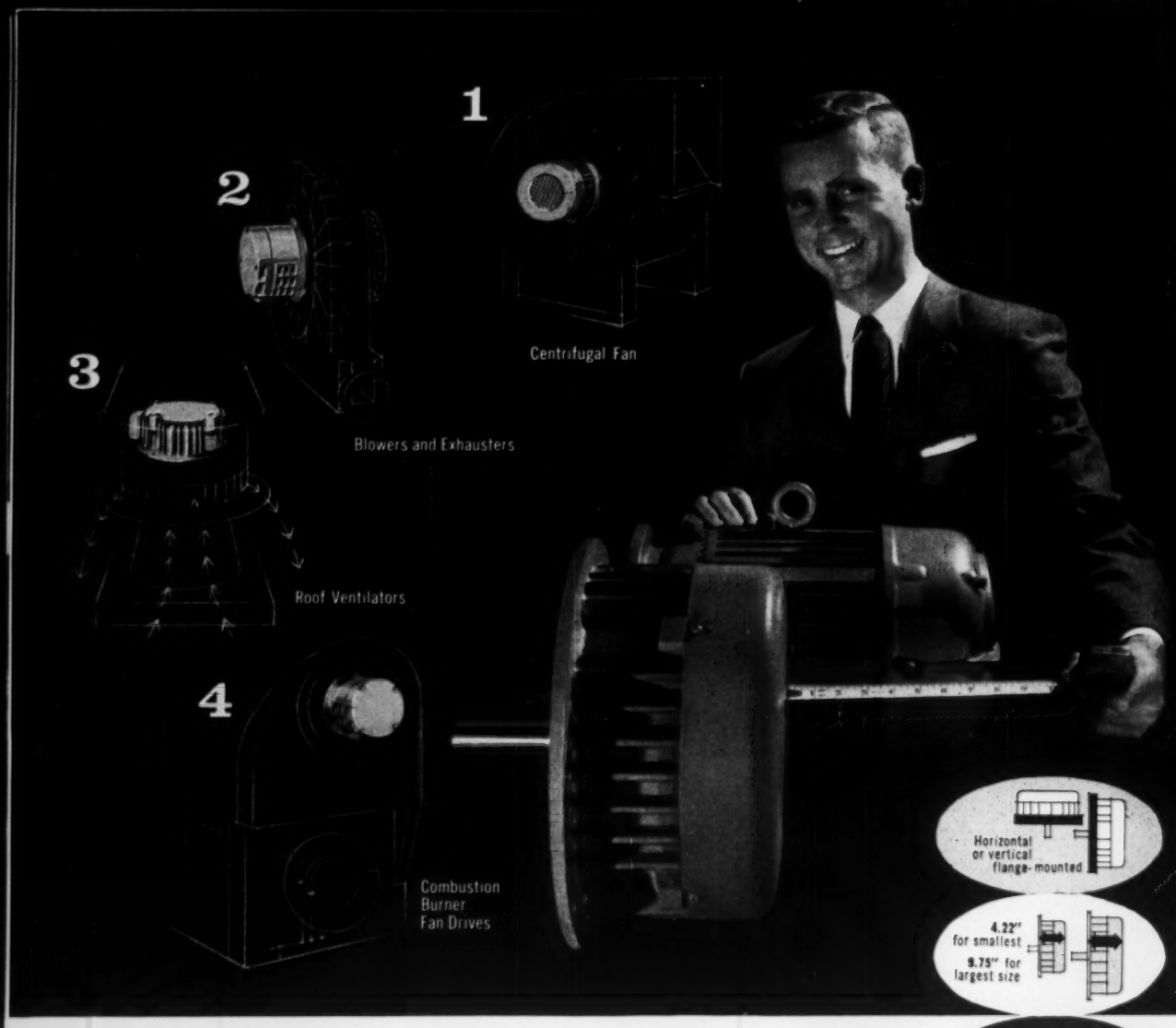
NEW INDUCED DRAFT FIRING—automatically controls fuel/combustion air ratio, high negative pressure in combustion chamber adds extra safety; extra efficiency because of complete control of combustion air.

NEW AIRFOIL COMBUSTION CHAMBER—stainless steel, ribbed for extra strength and channeling of airflow—guaranteed for 10 years. Longest possible flame travel for complete combustion within primary heat transfer area.

NEW LOW-SPEED FANS—forwardly curved, low-speed, double inlet fans with high efficiency reduce horsepower requirements in the new Counterflo drastically, operating costs are lower.

NEW DISCHARGE PLENUM—distributes heated air at high velocity without annoying drafts. Adds new flexibility to warm air distribution patterns.

Bulletin 564 describes the many new features of the new Dravo Counterflo heater. Write or phone for your copy today. Address Dravo Corporation, Dravo Building, Pittsburgh 22, Pennsylvania.



New Pancake motor is up to 60% shorter — saves space on fans or blowers

Louis Allis Pancake Motor offers many advantages for use in air-moving equipment

The Louis Allis Pancake Motor offers substantial savings in space, weight and installation cost when used for powering fans, blowers and ventilators.

It is an extra short length flange-mounted motor that saves space by hugging the contour of the fan housing. It is up to 60% shorter and 33% lighter than standard motors — blends into the housing, doesn't protrude, keeps overhanging weight and moment-arm low. And there's a decided saving in space over foot-mounted motors that require a special base or right-angle pedestal for mounting.

This new motor has conventional radial air gap construction, assuring excellent torque characteristics and performance.

Housing and flange are one piece, which permits accurate internal machining. This, plus the use of large pre-lubricated bearings, greatly extends bearing life and reduces noise level.

Sized from ¾ to 15 hp; 3600, 1800, 1200, and 900 rpm; open drip-proof and enclosed non-ventilated and fan-cooled enclosures. For more information, contact your local Louis Allis District Office, or write for Bulletins 2100 and 2150 to The Louis Allis Co., 453 East Stewart Street, Milwaukee 1, Wisconsin.

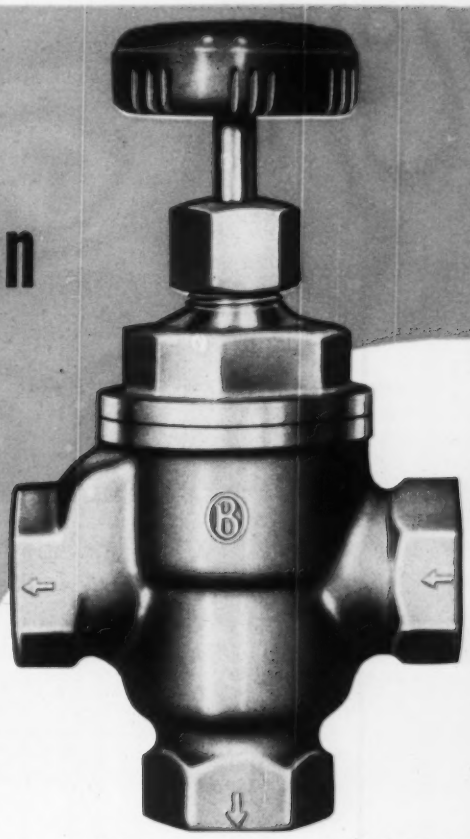
LOUIS ALLIS

SM-111

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

Use this O-B Valve Combination

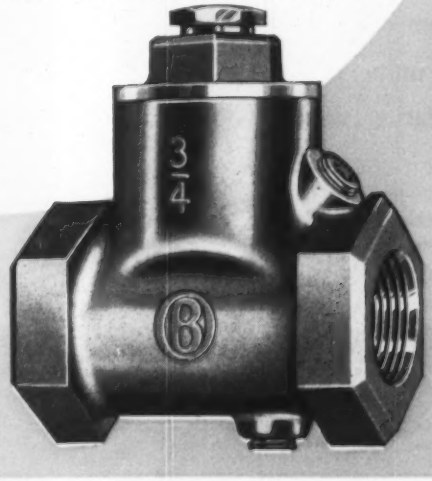
. . . for complete balancing . . . for individual temperature control in Central Air Conditioning and Heating



Here's the modern way to use valves to regulate operation of a central air conditioning or heating system.

For balancing use O-B Equatemp®, available with either threaded or solder-type pipe ends. It balances and shuts off and can be used for purging. Thus it does a job that formerly required two or more valves or fittings.

Solder end valves (No. 3700) can be furnished in ⅜, ½ and ¾-inch sizes. Threaded end valves (No. 3800) are available in ½ through 1½-inch sizes.



For separate control of individual units, use the No. 4600, O-B's new low-cost three-way valve. Its parallel, double-seat construction enables occupants of each room to regulate temperature to fit their individual comfort, without affecting other units in the system.

Regardless of the position of the three-way valve, the quantity of water pumped through the system does not change. This means pump delivery remains constant. Danger of overloading pump motors is virtually eliminated.

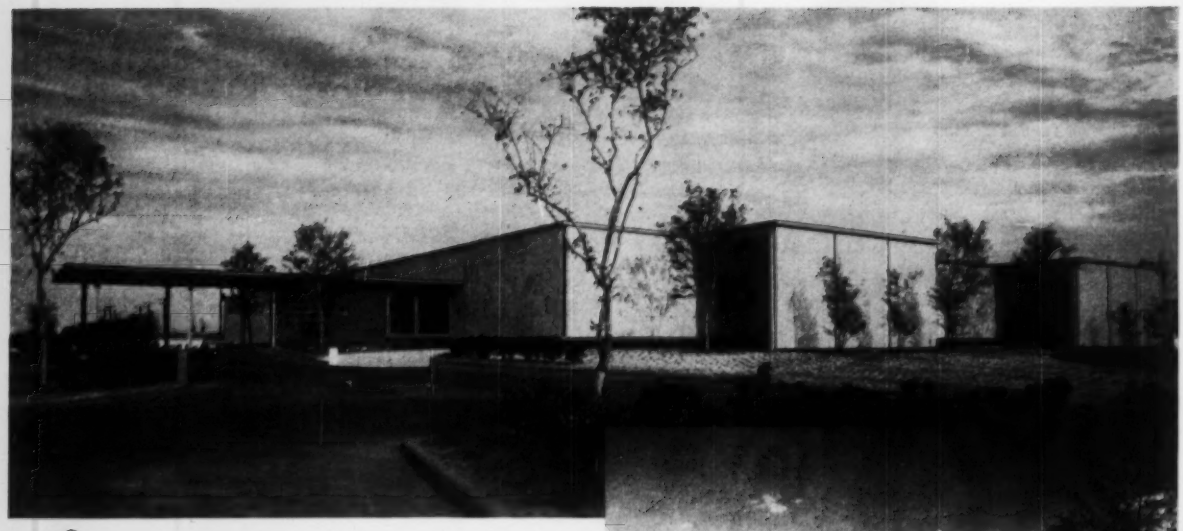
The 4600 is available with either threaded, or solder-type pipe ends. Use it with the O-B Equatemp to get an easily balanced, closely controlled system at a low price.

Available in ⅜ and ½-inch sizes only.

Ohio Brass

MANSFIELD OHIO, U.S.A.

4569-VR



Texas Instruments' Industrial Instrumentation Division building in Houston, Texas.

Texas Instruments' building at 6000 Lemmon Avenue, Dallas, Texas, manufacturing location of 90% of the world's silicon transistors.

BIG GIANT IN ELECTRONICS INDUSTRY USES

THERMAL
Air Conditioning for New Plants

Texas Instruments Incorporated, a leader in precision electronics and semiconductor fields, installed Thermal Engineering air conditioning equipment in its new Industrial Instrumentation division plant in Houston and in the latest addition to its main plant in Dallas, both projects being part of a continuing multimillion dollar TI expansion.

Thermal Engineering manufactures a complete line of horizontal and vertical air conditioners to fit into every architectural plan in every climate. Superior Thermal equipment includes central plant and multi-zone units, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers. Write for complete, detailed catalog.

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Average quality grain structure of commercial copper tubing.

United precision tested tubing "cuts production costs"

Exact temper is the key to tubing that easily and quickly meets your bending, forming, flaring and expanding requirements without danger of damage and loss. It saves on labor, time and waste . . . contributes significantly to production economy.

The tubing temper specified . . . from dead soft to hard . . . is the tubing temper United delivers! How? By the constant application of precision quality control checks of tubing grain structure . . . the key to correct temper.

United, seamless aluminum, copper, and copper base alloy tube is conveniently available in coils, straight mill lengths or cut to your specifications.

For complete details, samples, and fast delivery, write, wire or phone:

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1497 Elmwood Avenue, Providence 7, Rhode Island

Specify **UNITED** *for aluminum, brass, copper tube and wire...brazing alloys*

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Master them with SPORLAN PEAK PERFORMANCE LEVEL-MASTER CONTROL

LMC LEVEL MASTER CONTROL

The LMC consists of a standard Sporlan thermostatic expansion valve with a Level Master element and an insert bulb containing a low wattage heater. This perfect combination assures a positive liquid level control for all flooded systems.

The LMC feeds with a modulated flow, not an ON or OFF action. It is not affected by turbulence or agitation that might occur in the low side. Its effects are that of striking and maintaining a constant liquid level.

The insert bulb controlling the liquid level has no moving parts . . . it is not a mechanical float device.

The insert bulb can be easily and economically installed directly in the shell, accumulator or liquid leg for direct contact with the refrigerant on either new or conversion installations . . . no need for special balance line piping.

Get Peak Performance with the Sporlan LMC on all flooded systems using Refrigerants 12, 22, 500, or 717, whether they are Sharp Freezers . . . Hardening Rooms . . . Brine Chillers . . . Continuous Freezers . . . Milk Storage Vaults . . . Bottling Machines or Cold Storage Warehouses.

For complete details on the Sporlan LMC, ask your Sporlan Wholesaler for Bulletin 60-15.

SPORLAN VALVE COMPANY
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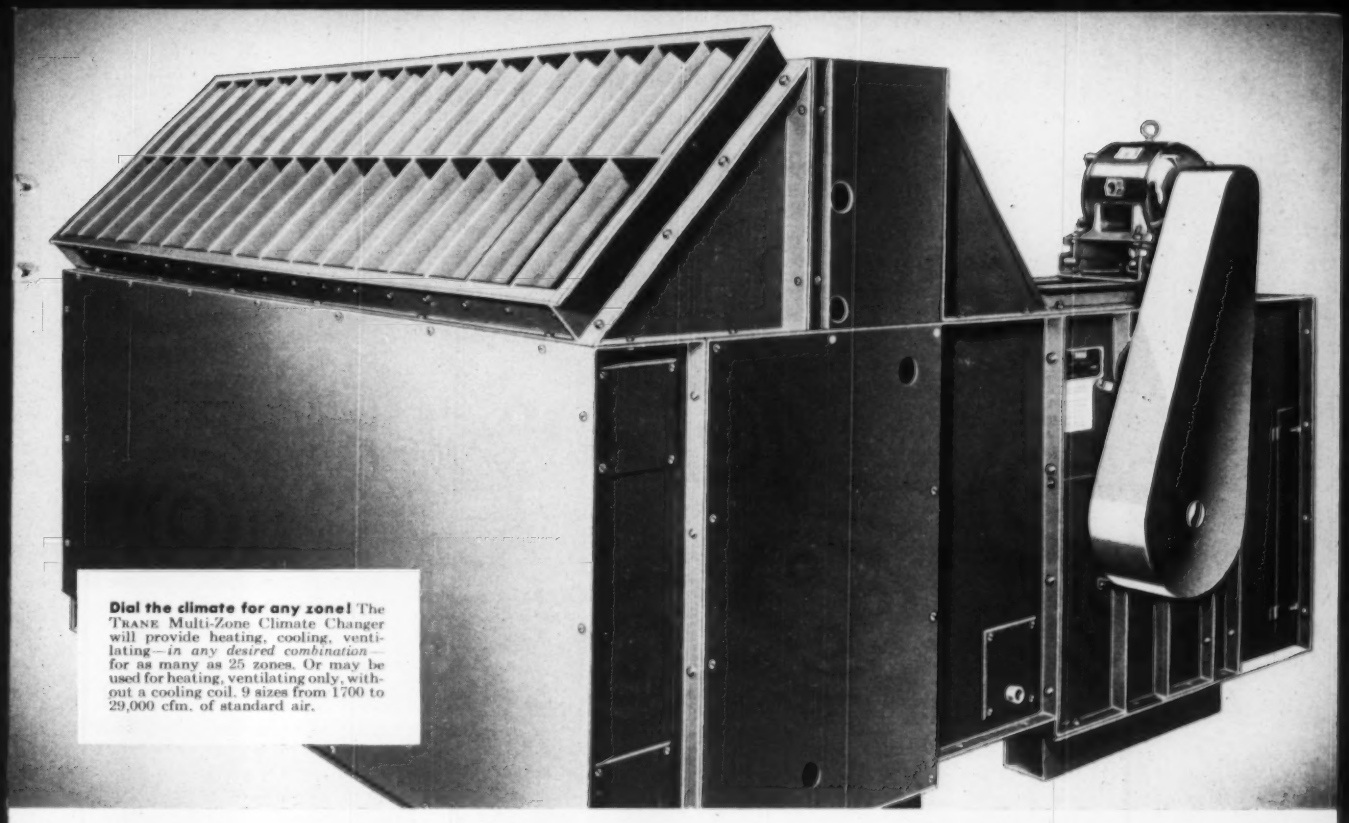
EXPORT DEPT. AD. AURIEMA, INC., 85 BROAD ST., NEW YORK 4, N. Y.



Dial the climate for any zone! The TRANE Multi-Zone Climate Changer will provide heating, cooling, ventilating—*in any desired combination*—for as many as 25 zones. Or may be used for heating, ventilating only, without a cooling coil. 9 sizes from 1700 to 29,000 cfm. of standard air.

Heat, cool, ventilate 25 zones with one Trane Climate Changer!

Multi-Zone units supply different air conditions for different zones—at the same time!

Here's easy-to-install air conditioning for buildings where individual units in each zone would be too costly. It's the TRANE Multi-Zone Climate Changer that supplies complete air conditioning . . . or any combination of heating, cooling, ventilating. It's especially useful for buildings that require maximum cooling in one or more zones while, at the same time, other zones may require less cooling, *or even heating.*

Next time you plan an air conditioning job, make it a TRANE Multi-Zone Climate Changer. Talk to your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

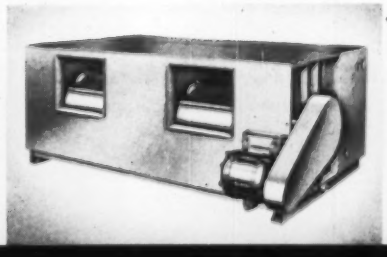
CHECK THESE CLIMATE CHANGER FEATURES:

- **No leakage.** Adjustable hot deck felt strips insure tight closure. Damper blades close tightly against strips, maintaining unit capacity, eliminating zone overheating due to leakage. *Standard on all* TRANE *Multi-Zone* Climate Changers.
- **Constant volume** of air at different temperatures. Does not accomplish temperature control by varying air quantities.
- **Centralizes piping** and controls in one panel.
- **One source** of chilled water (or refrigerant for DE coils).
- **Eliminates reheat** coils and their controls in zone ducts.
- **Sectionalized construction** for fast, easy installation.
- **Full-length damper section** for each full-length coil smooths out air flow, improves air distribution.
- **Full-width drain pan** under coil-damper section.

For any air condition, turn to **TRANE**

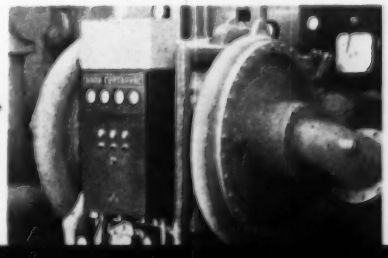
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

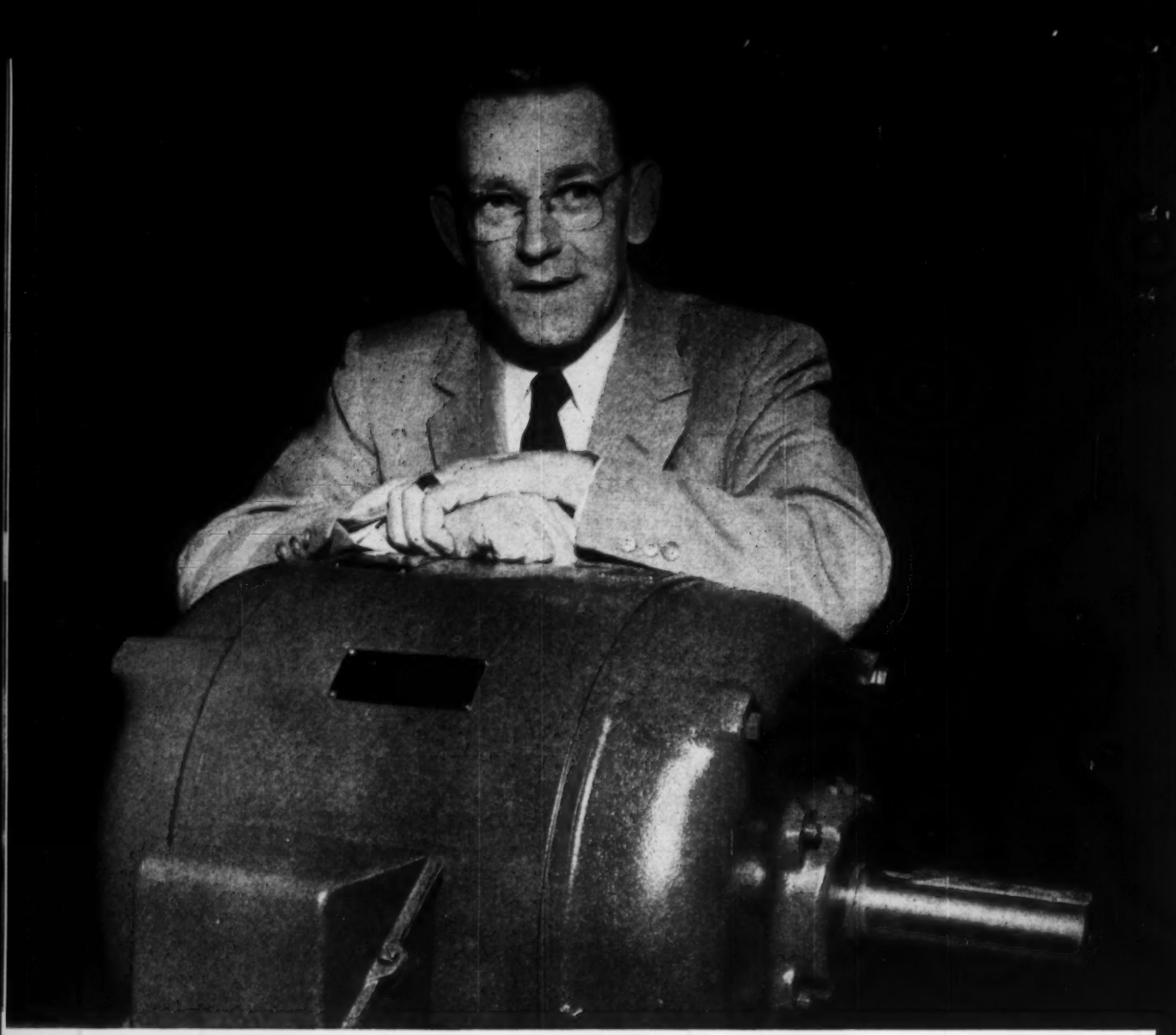
THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN.
• TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES



Air condition one zone with this standard TRANE Climate Changer. Horizontal or vertical units from 600 to 29,000 cfm.

Cut power costs with this TRANE CenTraVac water chiller. Automatically paces itself to supply just the cooling needed.





How to cut costs with the **RIGHT** motor

Don't be baffled by power factors, torques, efficiencies, and starting, accelerating and thermal characteristics, or housing, horsepower and speed control. Let Century Electric help you balance these factors. You can show your customers they'll have lower operating and maintenance costs with the *right* motor.

Here's how Century Electric can help you, too:

10,000 Choices—Century Electric engineers can help you specify the right motor without having to rely on a few types to do all jobs. Century Electric makes a complete variety of integral horsepower motors. Over 10,000 types up to 400 hp. There is one for every type of equipment. For all operating conditions, too—dusty, corrosive, explosive or moist.

Application Know-How—Every Century Electric sales engineer knows motor drive systems because he sells motors and nothing but motors. Often he can give you on-the-spot answers. If not, he can turn to an engineering staff that comes up with quick answers.

You can get the right motor for your equipment just by contacting your nearest Century Electric Sales Office or Authorized Distributor. A Century Electric sales engineer will be glad to help you.

CENTURY ELECTRIC COMPANY

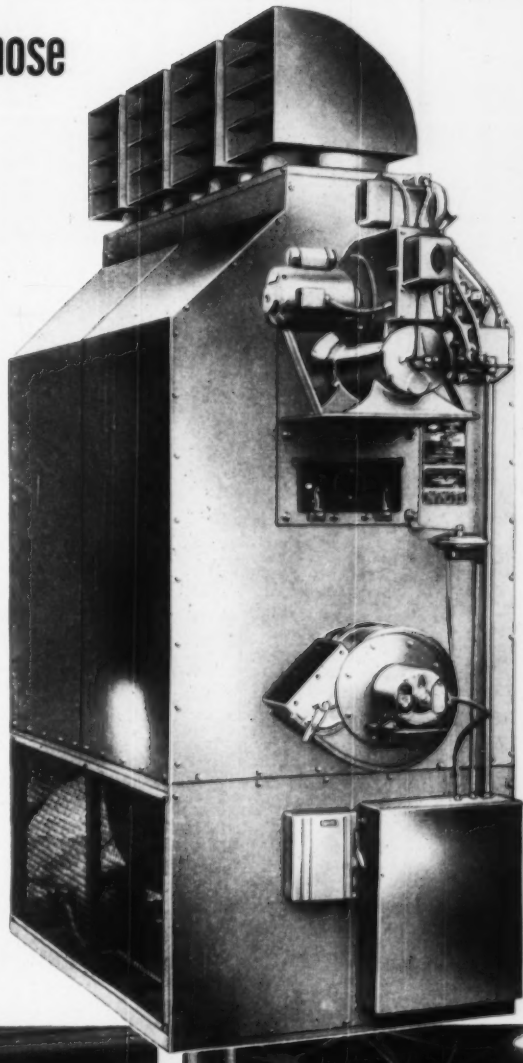
St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

58-21

Specify LENNOX for those BIG heating jobs!

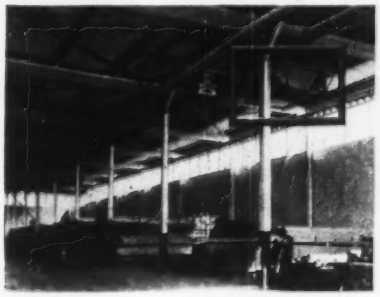
FROM THE WORLD LEADER IN WARM AIR HEATING COMES THIS NEW FIELD-PROVED INDUSTRIAL HEATER . . . 400,000 to 2,000,000 Btu/h



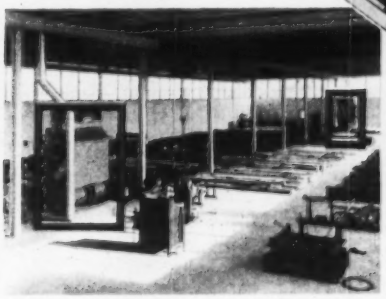
Installation flexibility; that's the Lennox "AT" series industrial heater. No task too large or small—designed for space heating, make-up air, drying or oven application—with your option of floor, horizontal or inverted units. And you can use oil, gas or combination fuel. In every installation Lennox engineering produces *exceptional* efficiency. Here are just a few of the reasons:

- ***4-pass counter flow design*—gets more heat from the flame (no internal baffles).**
- ***Double casing with metal radiation shield*—provides insulating curtain of air to hold DOWN cabinet heat losses.**
- ***Stainless steel combustion chamber*—prevents failure due to unrelieved stress. Warranted for 10 years!**
- ***One master controller. . .*eliminates non-standard, hard-to-replace control system components.**

Send for complete engineering data and specifications; see for yourself why plant engineers the country over are specifying Lennox "AT" series heaters!



One of four Lennox gas-fired heaters at C. A. Roberts Company, Detroit mfr. of steel tubing. Mounted at ceiling height, this space saving 500,000 Btu/h heater is tailored to the job.



Two oil-fired Lennox heaters in Wheelock-Lovejoy's steel warehouse (Centerline, Mich.) provide warm air heating for 20,000 sq. ft. Units are 750,000 and 1,000,000 Btu/h capacity.

Five gas-fired Lennox heaters at Wm. Montgomery Co. warehouse, King of Prussia, Pa. Fresh air introduced by heaters replaces the truck-exhaust foul air.

LENNOX Industries Inc.

INDUSTRIAL DIVISION

1701 EAST EUCLID • DES MOINES, IOWA

MAIL COUPON - - - Today

LENNOX INDUSTRIES INC.
Industrial Division, Dept. HP-8
1701 East Euclid, Des Moines, Ia.

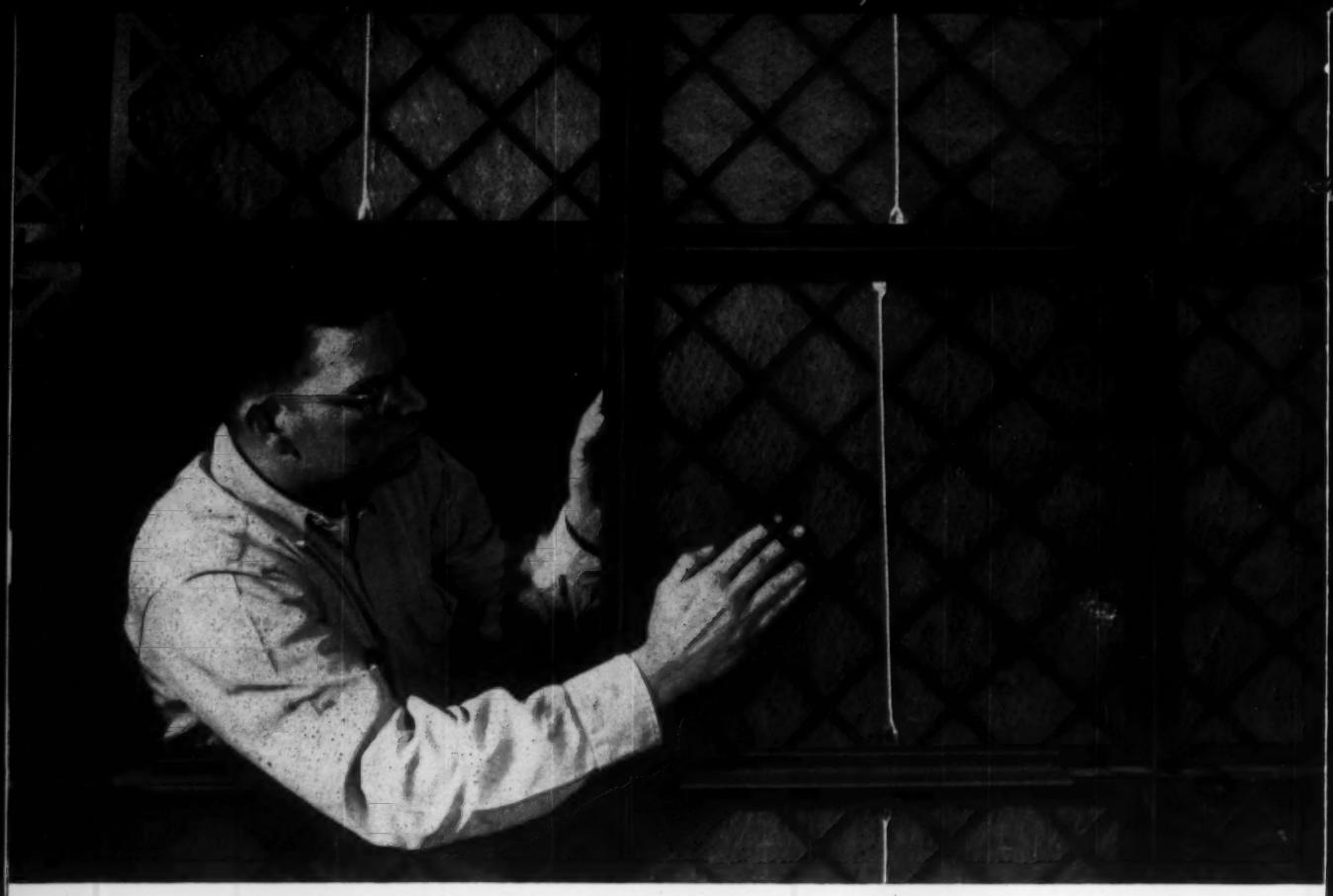
Please send me—without obligation—complete specifications and engineering data on Lennox AT series Industrial Heaters.

Name _____

Company _____

Address _____ City _____

Title _____



"The new PPG Glasfloss Safety-Grille filters definitely improved the service of our air filtering system," states Mr. Arthur C. Kercher. "Their one-piece chipboard construction has eliminated blow-outs and cut replacement time by 40%."

"New PPG Glasfloss® Safety-Grille* filters eliminated blow-outs, reduced replacement time by 40%"

*TRADE-MARK

reports Mr. Arthur C. Kercher, Air Conditioning Engineer, Joseph Horne Co., Pittsburgh, Penna.

"The new PPG Glasfloss Safety-Grille filters greatly improved our air filtering operations at Joseph Horne Co.," states Mr. Kercher.

NO BLOW-OUTS

"With the older type metal grille filters previously used, we experienced frequent blow-outs. Air is drawn through the filter bank at a high velocity; but since switching to Glasfloss Safety-Grille filters, the blow-out problem has been eliminated.

SAFER, FASTER INSTALLATION

"The new chipboard grille of the Safety-Grille filters is superior to the metal grille filters we previously used. Workmen now install the filters 40% faster than before, because there is now no danger of being cut by sharp metal edges."

LONGER SERVICE, COST SAVINGS

"The sturdy one-piece construction of the frame and grille means that we cut costs through their long usage (12 to 16 weeks) and their ease of handling."

DO YOUR AIR FILTERS GIVE YOU THIS GOOD SERVICE?

The new Glasfloss Safety-Grille filters will improve your air filtering system. They are available in a complete range of sizes. Call your local Glasfloss Distributor or PPG Warehouse for top service.

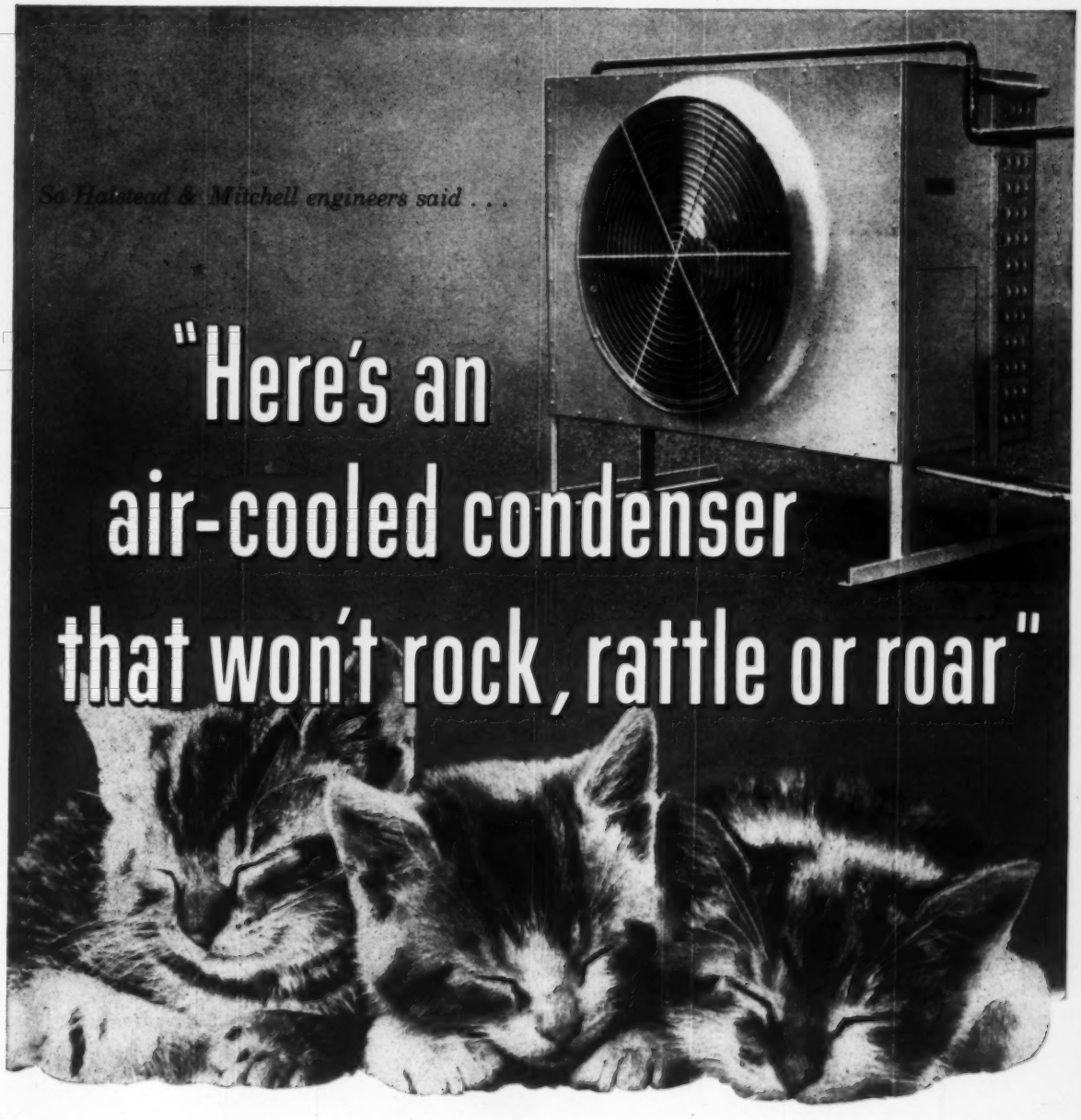
A PRODUCT OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis.

75th ANNIVERSARY 1883—1958

SYMBOL OF SERVICE FOR SEVENTY-FIVE YEARS

PITTSBURGH PLATE GLASS COMPANY



So Halstead & Mitchell engineers said . . .

"Here's an air-cooled condenser that won't rock, rattle or roar"

They planned it that way. H&M Air-Cooled Condensers had to be free of the vibrations, rattles and fan noise that plagued so many competitive models. And comments from contractors and users prove they hit their target.

The extra rugged casing won't loosen with use. Lock-tight construction avoids annoying rattles. Four-bladed, deep pitch fans are driven at slow speed for really quiet operation.

Halstead & Mitchell condensers are dependable, too. Large coil and exclusive Turbu-Flo design add more surface, improve heat transfer by up to 15%. Wide fin spacing prevents condenser clogging by dirt or other air-borne particles.

Designed for use with Refrigerants 12 or 22, H&M Air-Cooled Condensers are available in twelve models, from 3 to 50 tons capacity. Floor or ceiling mountings. Multiple circuiting for specified requirements, at no extra cost. Centrifugal Fan models are available for inside installations requiring ductwork.

Ask for H&M Air-Cooled Condensers at your distributors, or write for literature. Halstead & Mitchell, Bessemer Bldg., Pittsburgh 22, Pa.

HM

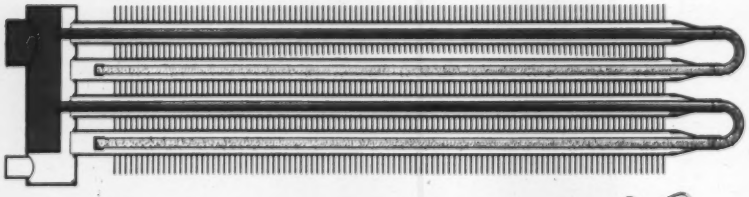
Halstead & Mitchell

Air-Cooled Condensers • Cooling Towers • Water-Cooled Condensers • Finned Coils

The unique "U" turn in the design of Series T Surface with TROMBONE steam distributing tubes doubles the surface area over which steam quantities are distributed. This achieves a uniformity of steam distribution unmatched by conventional arrangements. Because the exclusive Nesbitt TROMBONE construction results in only one half the normal number of connections to a supply header, the quantity of steam supplied to the first leg of each TROMBONE distributing tube is double what it would be in a conventional design. This higher rate of steam per distributing tube is particularly important when a small steam quantity is being supplied. The same quantity of steam will travel twice as far along the surface length and contact twice the surface area.

Net results: Uniform discharge temperatures and *maximum* freeze protection over the entire capacity range—from 100% down to the smallest practicable supply of low pressure steam under valve control.

Nesbitt Trombone Surface:
Note how the steam is apportioned to every other tube. The same steam quantity goes *twice as far* in each tube. Even small steam quantities are distributed over the full surface length. Results: uniform final temperatures, full length of coil; freeze protection; perfect control with modulating valves.

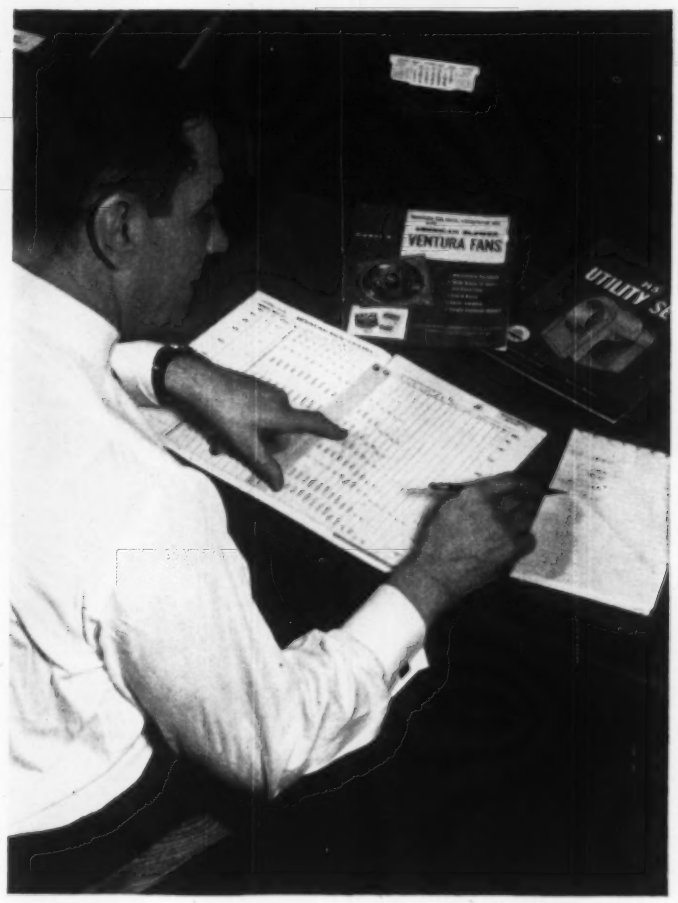


Nesbitt HEATING SURFACE

WITH THE TROMBONE STEAM DISTRIBUTING TUBES

Made and sold by John J. Nesbitt, Inc., Phila. 36, Pa. • Ask for publication 305-1

"PRE-ENGINEERED" VENTILATION



— another example of how you benefit when you install American Blower ventilating equipment

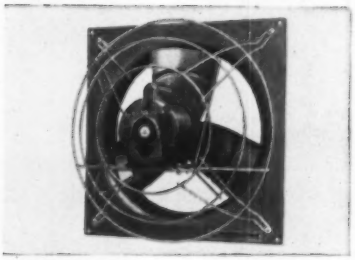
Show your prospects how to improve employee efficiency and morale quickly, economically. Sell them good ventilation, *pre-engineered* by American Blower.

Sales point: No on-the-job engineering is needed when your customers ventilate with American Blower equipment. Our engineers already have designed and tested a fan exactly right for *any* job. So it's easy to pick the proper model directly from the catalog. And you offer buyers even *more:*

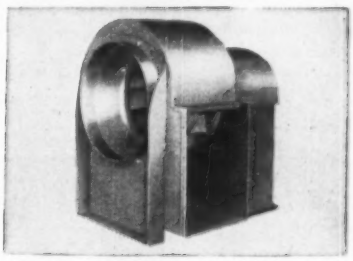
- **Packaged ventilation** — Complete, ready to use. Fast, economical installation.
- **"Off-the-shelf" delivery** – Fast service from *local* stocks on most models.
- **Certified Ratings** – Air deliveries meet rigid standard test codes.

Ring up *more* sales with the *complete* line of American Blower fans for every ventilating job. Bonus: equipment selection assistance from one of our 73 branch offices. For details, write: American-Standard,* American Blower Division, Detroit 32, Mich. In Canada: Canadian Sirocco products, Windsor, Ontario.

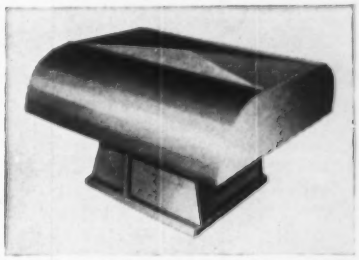
It pays to standardize on American Blower!



Ventura Fans — quiet, efficient, economical. Sizes from 10" to 30".



Utility Sets — Direct drive, sizes 3" to 12¼"; V-belt drive, 9" to 36".



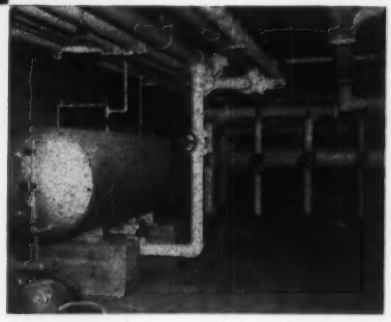
Power Roof Ventilators — available through American Blower branches.

* American-Standard and Standard are trademarks of American Radiator & Standard Sanitary Corporation.

American-Standard Products

AMERICAN-Standard

AMERICAN BLOWER DIVISION



Plumbing and fire protection with

USS National Pipe—

St. Louis Federal Housing Project

USS NATIONAL Steel Pipe was used in the plumbing and fire-protection systems of the George L. Vaughn apartments —federal housing project in St. Louis, Missouri. Approximately 11,304 feet of pipe, ranging in size from ¾" to 8", comprises the systems in the four buildings.

In the plumbing systems, the pipe is used for hot and cold water supply mains and hot water return mains. In the fire-protection systems, an 8" main supplies water to each building, where there is a fire hose cabinet on each landing supplied by a 6" riser. A constant pressure of 100 psi is maintained throughout each fire-protection system.

Need first-quality pipe for air-conditioning, heating and power installations? Need seamless and standard pipe that will pay you back in outstanding service many times over for every dollar you spend for it? Then say "NATIONAL PIPE" every time. And, for further information or immediate assistance with your pipe problems, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

USS and National are registered trademarks

"The world's largest and most experienced manufacturer of tubular products—NATIONAL TUBE"

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

Burn COAL the MODERN WAY

with DETROIT STOKERS and SAVE!

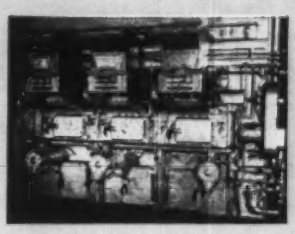
Coal is the economical fuel in most industrial areas. Safest to handle and store, its steady and continued supply is assured by huge reserves.

With a Detroit Stoker you can burn coal the modern way . . . saving 10% to 40% over other fuels.

Detroit Stokers are dependable, durable . . . last for decades. There is a type of Detroit Stoker to meet your needs.

Let us show you the savings available. Recommendations by our engineers will cost you nothing.

DETROIT ROTOSTOKER



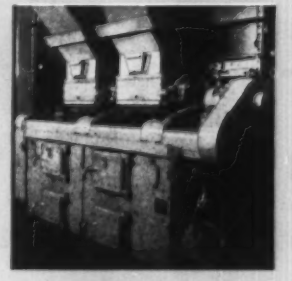
Spreader stoker. Economically burns all grades of Bituminous coal or Lignite. Power, hand dumping or stationary grate types.

DETROIT LOSTOKER

Compact underfeed stoker for smaller boilers. Capacities 3,000 to 12,000 pounds steam per hour. Plunger feed, mechanically driven side cleaning. Coal feed and air supply may be automatically controlled.

DETROIT ROTOSTOKER—TYPE C-C

(Continuous Cleaning) Reciprocating grates that slowly discharge ash at front. Steaming capacities from approximately 5,000 to 75,000 pounds. Smokeless with wide load range.



DETROIT SINGLE RETORT STOKER

(Detroit UniStoker)

Side cleaning, underfeed stokers. Motor or turbine driven. Adjustable feed provides manual and automatic control. Capacity range 12,000 to 24,000 pounds steam per hour.

DETROIT ROTOGRATE STOKER

Spreader stoker for higher capacities up to 400,000 pounds. Forward moving grates that discharge ash at the front. Higher burning rates for longer periods. Heavy duty.

DETROIT DOUBLE RETORT STOKER

Side cleaning heavy duty underfeed stoker with two retorts, mechanically driven. Available for capacities from approximately 20,000 to 34,000 pounds steam per hour. Requires no basement.

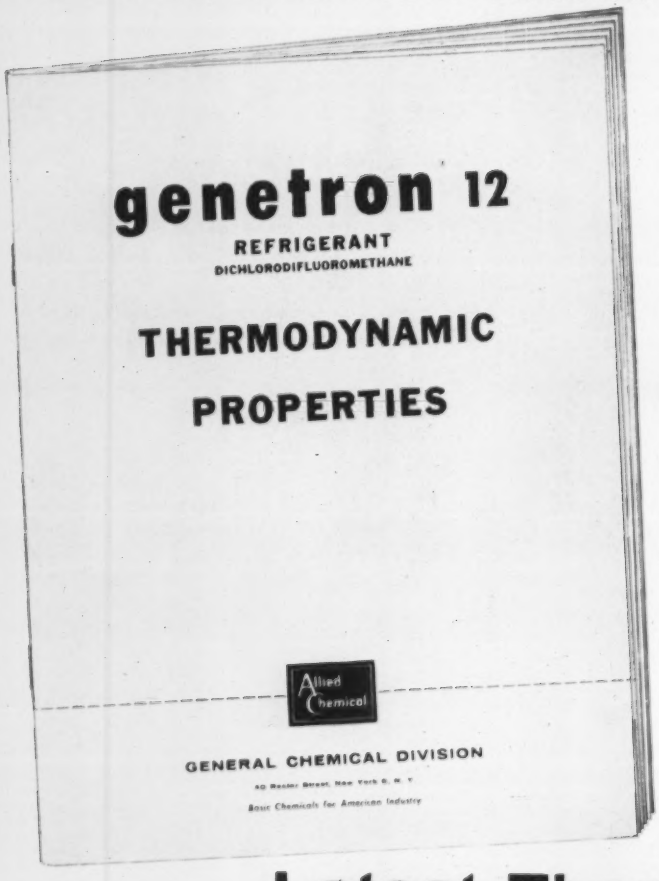
DETROIT STOKER COMPANY

MAIN OFFICE AND WORKS • MONROE, MICHIGAN

District Offices or Representatives in Principal Cities

DETROIT SINCE 1898 STOKERS

NEW! *from General Chemical research...*



Here are essential new data for every refrigeration engineer—on dichlorodifluoromethane, the most widely used fluorinated hydrocarbon refrigerant.

Latest Thermodynamic Tables on genetron® 12

Dichlorodifluoromethane

These new 36-page tables offer a number of important advantages over tables previously available:

1. Electronic computation completely eliminates computational inaccuracies.
2. Data are the best available, including new thermal data based on spectroscopic measurements.
3. The temperature range for superheat properties has been expanded in the most useful ranges; pressure intervals have been decreased. Saturated properties range from −150°F to 215°F in 1°F intervals. Superheat properties range from 0.1 to 500 psia.

WRITE TODAY (on business letterhead, please) for these important tables. We will be glad to send you free copies.

ALSO AVAILABLE! New thermodynamic tables released early this year on "Genetron" Super-Dry Refrigerants 11 and 22. If you do not already have copies of these tables, write for all three!

genetron®
SUPER-DRY REFRIGERANTS

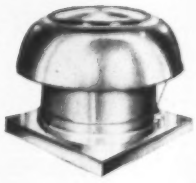
Allied Chemical

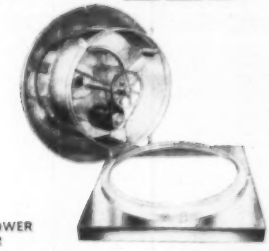
GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

JENN-AIR LAUNCHES

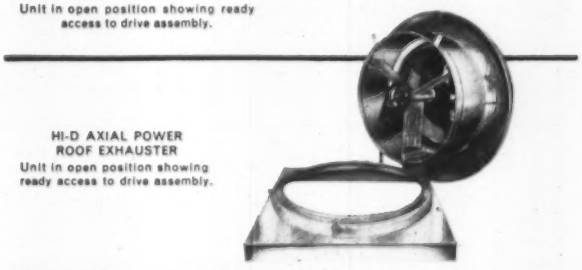
TWO NEW STARS INTO ORBIT

Hi-D CENTRIFUGAL AND AXIAL POWER ROOF EXHAUSTERS





HI-D CENTRIFUGAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.



HI-D AXIAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.

Observe These Outstanding Features Shared in Common by 2 New Jenn-Air Hi-Discharge Exhausters:

1—*Maintenance-Free all-aluminum housing* supplies strength without weight.

2—*Bird guard* of heavy gauge stainless steel construction comes as an integral part of every unit.

3—*Special vibration absorbers* reduce noise to an absolute minimum.

4—*Totally enclosed* full ball bearing, permanently lubricated, motor assures smooth, uninterrupted service. Air cooled application adds years to motor life.

5—*Tubular drive assembly* has permanently sealed, pre-lubricated ball bearings.

6—*Motor and drive* can be serviced from interior of building, if desired.

7—*Specially designed hinge* on housing permits ready access to damper and drive. Positive stopping device holds unit in open position. Simple locking mechanism keeps it tightly closed.

Now, for the first time, aluminum belt driven units combine high discharge with low-contour appearance

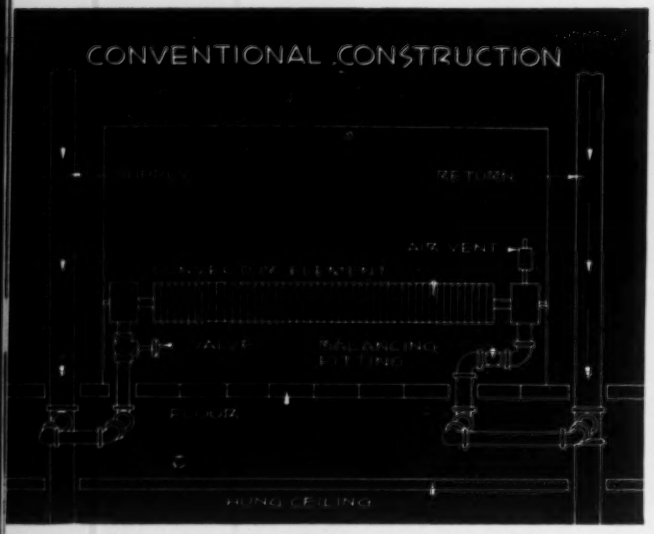
Since 1947 the power exhauster industry has looked to Jenn-Air for leadership. Now Jenn-Air starts its second decade by introducing two new and useful additions to its line: Hi-Discharge *Centrifugal* Power Roof Exhauster, Series HCB; and Hi-Discharge *Axial* Power Roof Exhauster, Series HAB. These exhausters fill the need for general area ventilation and have a clean engineering design that features compactness and serviceability. By locating the wheel at the top you derive the advantage of a high point of discharge which allows low curb construction. Thus, Jenn-Air units offer the lowest overall height of any exhauster on the market. Once you compare, you will decide on Jenn-Air.

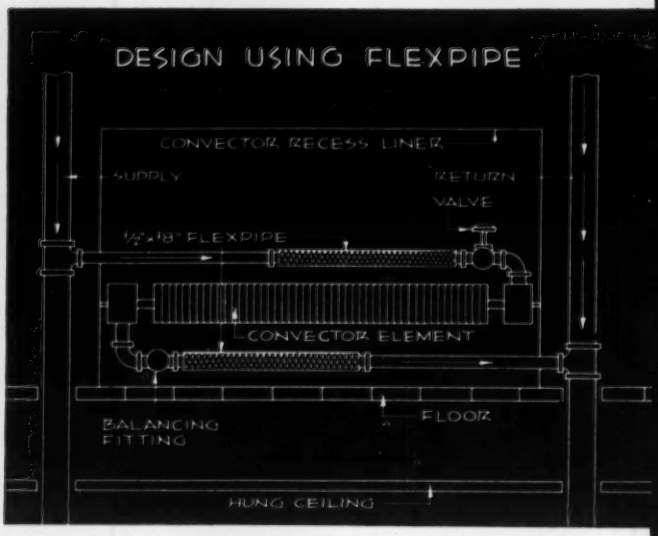
JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive • Indianapolis 7, Indiana

Member of Air Moving and Conditioning Association

APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®





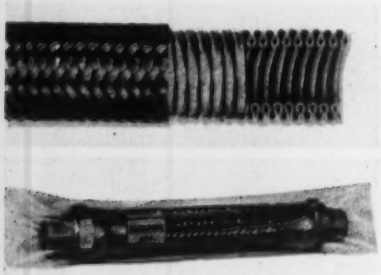
St. Charles Hospital, West Islip, N. Y. Architect and Engineer: Crow, Lewis & Wick, New York, N. Y.
Heating, Ventilating and Air Conditioning Contractor: H. Sand & Co. Inc., New York, N. Y.

Flexpipe connectors in hospital heating system eliminate through-floor convector connections

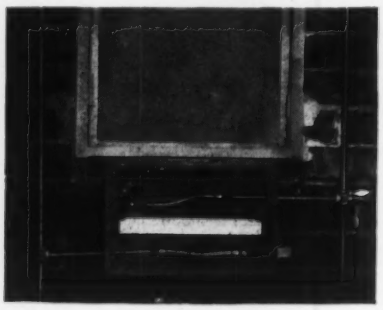
THE PROBLEM: The architectural engineers and contractor for the St. Charles Hospital, West Islip, L. I., were faced with no special technical problems in the two-pipe forced down-feed hot water heating system. They simply wanted to provide maximum floor space and keep total installed costs at a minimum. Had they followed conventional practice, they would have connected the convectors as shown in the sketch at the left, above. This would have involved sleeves through the floor for the stubs to the convectors – making connections overhead in the hung ceiling from a staging on the floor below, furring out walls to get space for making all the connections.

THE SOLUTION: By making connections in the convectors with Flexpipe (see sketch at right, above), the job was greatly simplified. Extreme accuracy was not essential in roughing-in because Flexpipe takes care of offsets and riser expansion. The piping hugs the wall leaving only enough space to accommodate insulation, for minimum loss of floor space. The radiator valves are located where they can be easily reached through access doors. The installation time and material cost of making through-floor connections were eliminated. And the final installed cost was lower than with the conventional method.

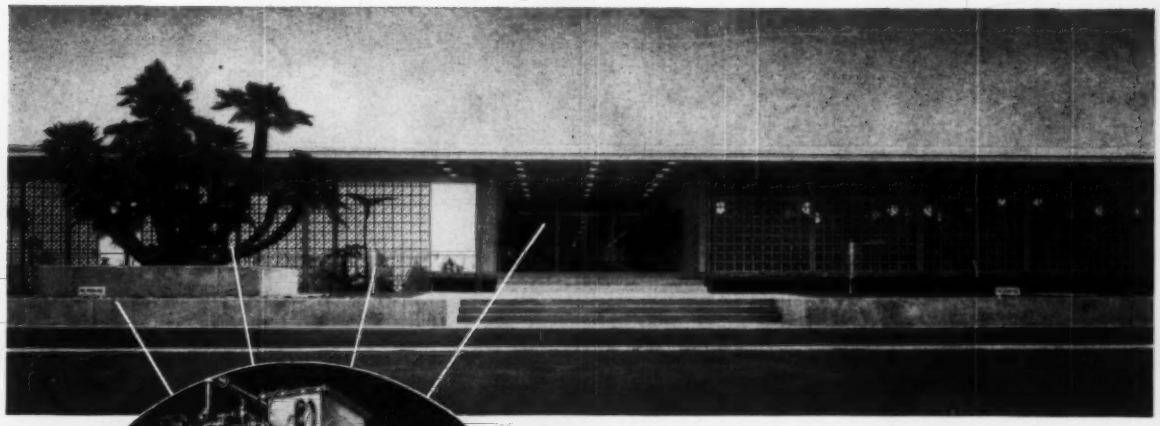
WHERE TO BUY. Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd. 58225



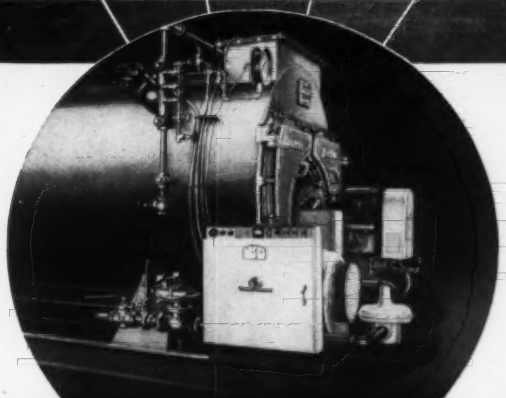
FLEXPIPE has core of seamless tin bronze tubing corrugated for flexibility. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing. Above, right: Piping and convector in place at St. Charles Hospital before being furred in, showing location of Flexpipe connectors.



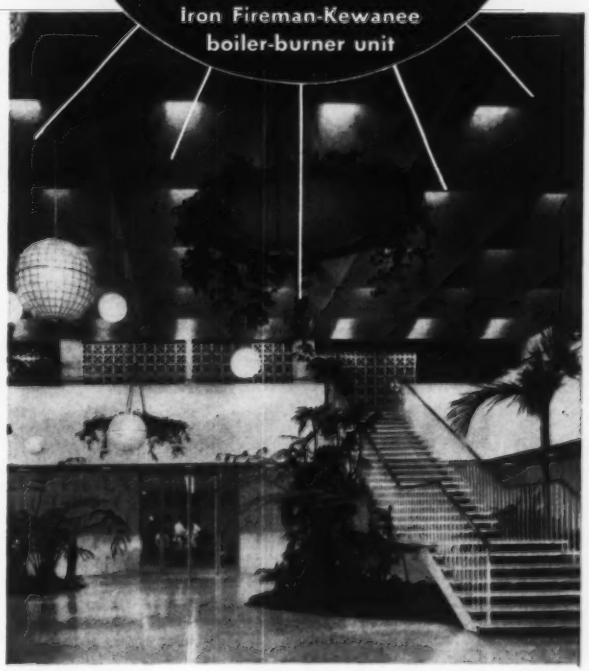
Flexpipe® an **ANACONDA®** product
made by The American Metal Hose Division
of The American Brass Company



Screened facade of Stuart Co. plant, Pasadena, California



Iron Fireman-Kewanee boiler-burner unit



Lounge and offices overlook spacious atrium

Architect: Edward D. Stone

Mechanical Engineers: Stockly & Bamford

Mechanical Contractors: Hickman Bros., Inc.

Where the *steam* comes from...

for both heating and pharmaceutical processing

One of the notable commercial buildings of the year combines maximum utility with such striking beauty that it has won nation-wide acclaim. Designed by Edward D. Stone, this plant is used by the Stuart Co. for the production of pharmaceuticals.

Up-to-the-minute mechanical equipment includes two Iron Fireman-Kewanee boiler-burner units. Due to forced draft firing, there is no stack to mar the symmetry of the building. Dual-fuel burners efficiently fire gas or any grade of light or heavy oil, with quick changeover.

Complete Iron Fireman boiler-burner units can be easily sized, specified and ordered from a single catalog, with a single model number.

Conservative rating permits an easy, economical "cruising speed" at rated output, with 50% reserve capacity and consequent minimum noise level and low maintenance costs.

Mail coupon for detailed information and specifications.

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT FOR HEATING, PROCESSING, POWER

IRON FIREMAN MANUFACTURING CO.
3085 West 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send catalog and specifications on following equipment:

- ☐ Complete boiler-burner units
- ☐ Forced draft firing unit only

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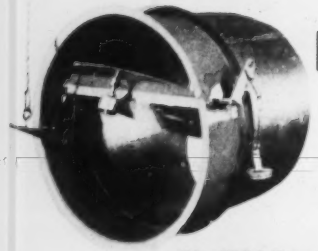
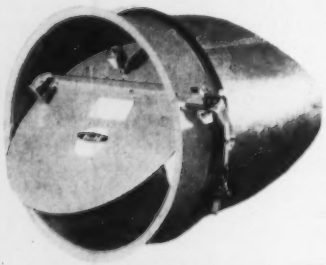
The Triple-Fuel M+MG2

Joins the Field Family of Draft Controls



M+MG2 Barochek for Solid Fuels

M+MG2 Single-Acting for Oil



M+MG2 Double-Acting for Gas or Oil-Gas

A new triple fuel control, the M+MG2 is available in 10″ through 32″ sizes for oil, oil-gas, gas,and solid fuel furnaces and boilers, employing either natural, induced or forced draft. A very heavy duty, highly sensitive control, it can maintain draft settings as low as .002″ and as high as .3″. Write for application engineering data.

field **FIELD CONTROL DIVISION** of H. D. Conkey & Company, Mendota, Ill.

AFFILIATES { Conco Building Products, Inc. • Brick, Tile, Stone
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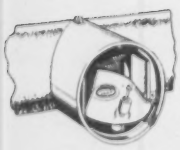
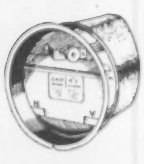
Represented in Canada by Ontor Limited, 12 Leswyn Road Toronto 10, Ont., Canada



Field M 6″ thru 9″

Field R 6″ and 6-7″

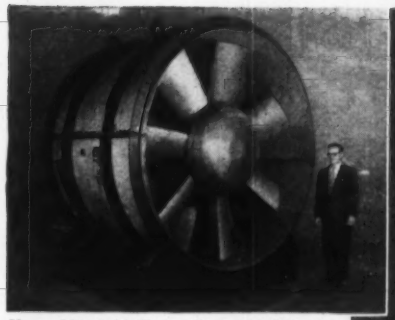
Field 6″ Incinerator Control



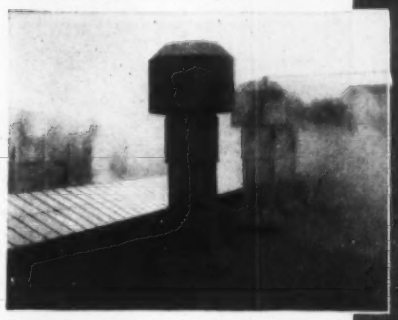
Field RC 6″ thru 9″

Field Scotty 6″ and 6-7″

Field MG1 7″ and 8″



Huge 96" Acid Fume Fan — 210,000 cfm "Buffalo" Axial Flow Fan with cast aluminum wheel, installed in a textile mill.



In Stack Hood Exhaust — Easy installation is a big advantage of the duct-size "Buffalo" Axials mounted in these stacks. Hoods give all-weather protection.

FOR TOP AXIAL FLOW FAN EFFICIENCY— IN BIG JOBS OR SMALL—

SPECIFY "BUFFALO" AXIALS

"Buffalo" Axial Flow Fans provide extremely quiet and efficient performance. This inherent efficiency is further improved by the "Buffalo" Vaneaxial outlet guide vanes. These carefully engineered vanes re-direct the swirling air at the fan outlet, converting it into increased forward thrust.

These sturdy, reliable fans are light in weight, permitting easy installation. Except for the largest models, no structural support or heavy foundation are required. "Buffalo" Axials can be installed as a section of the duct or stack in hood and other roof exhaust systems.

Duct-size "Buffalo" Axials save space by fitting in close to walls or ceilings. Space-saving installations include service as ventilation, exhaust and industrial air conditioning supply fans. They are widely used for applications ranging from paint spray booth exhaust to boiler room cooling.

"Buffalo" Axial Flow Fans are available for high or low temperatures, corrosive fumes, explosive atmospheres and other severe conditions.

Investigate the many advantages offered by "Buffalo" Axial Flow Fans. Contact your nearby "Buffalo" engineering representative, or write direct for Bulletin 3533-EF.

BUFFALO FORGE COMPANY
171 Mortimer St. • Buffalo, N. Y.
Buffalo Pumps Division • Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

The "contented feel" of an all copper installation!

MADE IN U.S.A.
TO THE STANDARDS
OF AMERICAN INDUSTRY
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"Contented" property owners are your best bet for repeat business and customer-recommendations that build new business. And, all-copper installations done with Hussey Copper have proved a vital wedge to this kind of customer-satisfaction. The reason?—Hussey Copper gives the fine appearance, lasting endurance and high efficiency that makes investors happy. To build a longer list of contented customers—make sure it's Hussey Copper and be sure!

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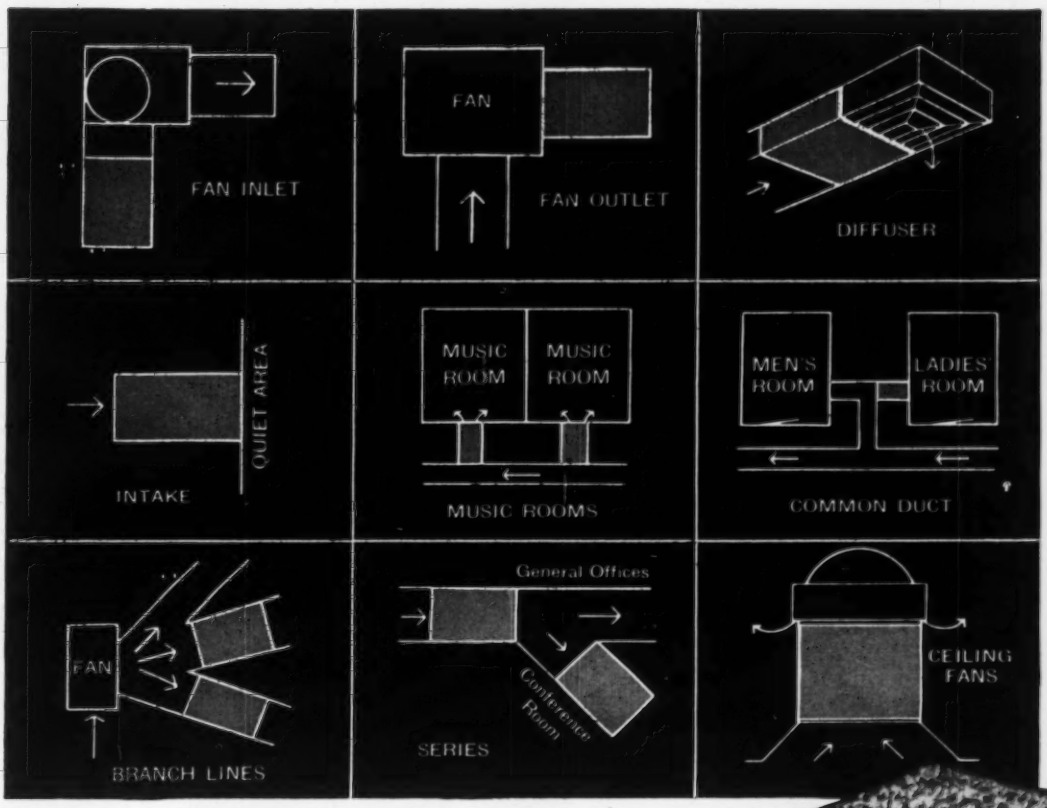
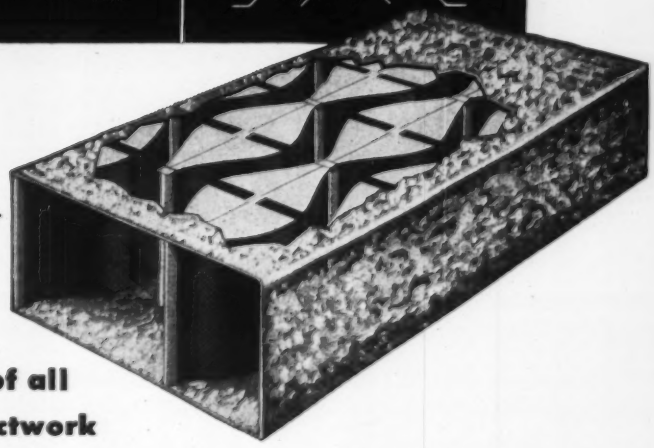


Every Building Needs *Aircoustat*® Sound Traps



AIRCOUSTAT silences all noise of all frequencies traveling through ductwork

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6208 Scott Street, Baltimore 3, Md.

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INDUSTRIAL SOUND CONTROL

Engineered Products Sold with ***Service***

SPECIFY • INSTALL

ALCO EVAPORATOR PRESSURE REGULATORS

Alco Evaporator Pressure Regulators accurately maintain evaporator pressure in either a single or multiple system, guaranteeing highest evaporator efficiency regardless of load changes.

Call your Alco Wholesaler—
Write for (Specifications) Bulletin # 183-57.

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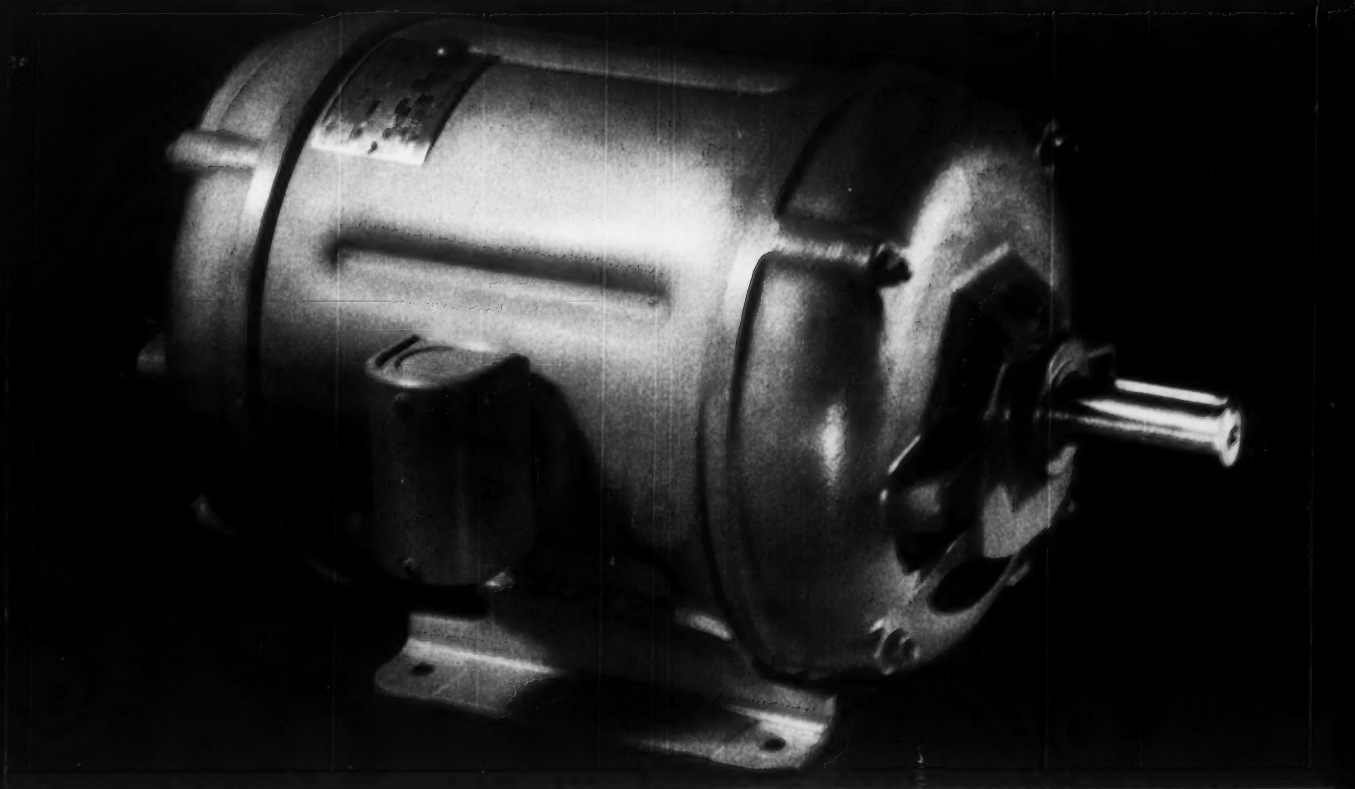
The one complete line of refrigerant controls: Thermostatic Expansion Valves · Refrigerant Distributors Solenoid-Valves · Suction Line Regulators · Flooded Evaporator Controls and Reversing Valves

Got a Real Tough Starting Problem ?



Single-phase Type RA ½ to 15 hp.

Wagner Repulsion-Start Induction Motors start heavy loads with low current

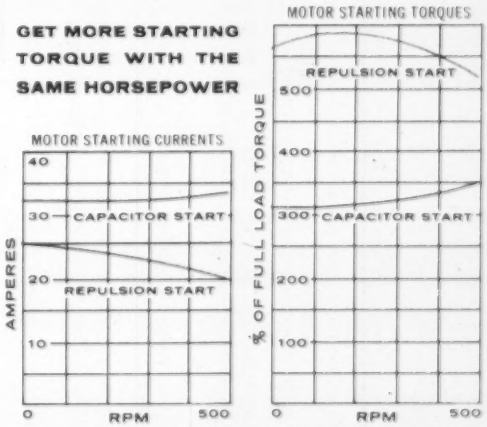
The Wagner Type RA is the work-horse of the single-phase motor field. It combines high starting torque for quick, easy starts with low starting current and minimum light flicker. It has a constant high operating speed, even under overload, and a flat efficiency curve over a wide operating range.

You practically eliminate service problems when you power tough single-phase applications with Wagner RA Motors. They have unmatched ability to start high inertia or heavy friction loads repeatedly and they give many years of unfailing service.

Let a Wagner Sales Engineer show you how these motors can be applied to your needs. Call the nearest branch office or write for Bulletin MU-220.

Wagner Electric Corporation
6400 Plymouth Ave., St. Louis 14, Mo.
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

GET MORE STARTING TORQUE WITH THE SAME HORSEPOWER



ONE HP, 1750 RPM, 60 CYCLES, 230 VOLTS

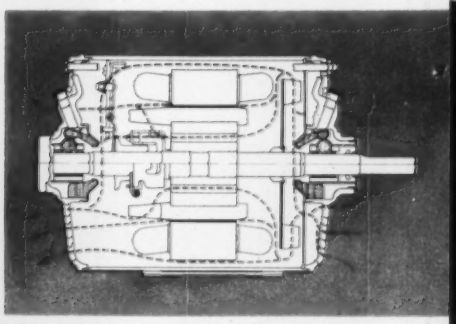
Integral Ratings, 1-5 hp are available in the latest NEMA Frame Sizes

H. P.	OLD FRAME SIZE	PRESENT FRAME SIZE
1	203	182
1½	204	184
2	224	213
3	225	215
5	254	254U

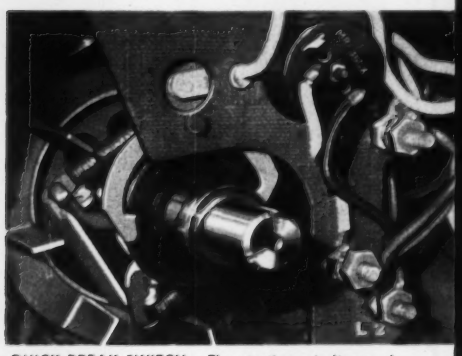
4 pole (1750 RPM, 60 cycle and 1450 RPM, 50 cycle) ratings are interchangeable in mounting dimensions with capacitor start motors of the same ratings.

Got a Normal Starting Application?

Single-phase
Type RK
⅙ through 5 hp.



EFFICIENT COOLING SYSTEM—The improved ventilating system used in these motors directs a large volume of air through the motor to effectively reduce temperatures and add to motor life. Cross section above indicates direction of air flow.



QUICK BREAK SWITCH—The starting winding and capacitor are disconnected from the line by this Wagner Switch—test-proved to make more than a million makes and breaks . . . the equivalent of two starts per hour for 50 years.

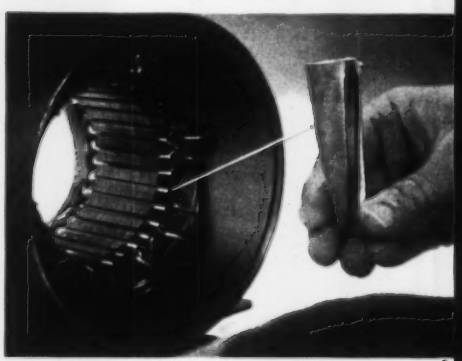
WAGNER CAPACITOR-START MOTORS provide dependable starts... long troublefree life

Here's the single-phase general purpose motor that gives more horsepower with less bulk—is rugged enough to permit direct mounting, compact enough to fit in tight spots. Available with sleeve or ball bearings — with rigid bases or with resilient mountings for exceptionally quiet operation.

ALL-ANGLE OPERATION

The sleeve bearing design in fractional hp ratings, has a positive lubrication system that permits operation in any position. All angle mounting can mean important savings in initial costs to manufacturers—can help the design engineer in a tight spot.

You can get these motors from leading motor distributors in your community and from Wagner Sales Offices in 32 principal cities. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details.



MYLAR* INSULATION — Mylar-paper laminated slot insulation gives top protection against moisture, adds thermal stability, to give more application versatility and longer life when unexpected overloads occur.

*DuPont Trademark

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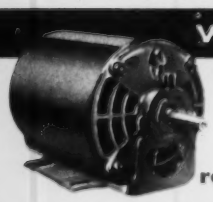
6400 Plymouth Ave., St. Louis 14, Mo.
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

WAGNER "48" SPLIT PHASE MOTORS . . . 1/6, 1/4, 1/3 hp.



for low starting torque requirements

If you need a small fractional horsepower motor for use on fans and blowers or on a wide variety of easy-to-start machines and appliances, you can't beat the Wagner "48" Type RB Motor. It offers all the advantages of the Type RK described above, with the exception of high torque capacitor starting. This smaller, lighter, limited use motor can solve many application problems economically.

WM58-6

Every Step of the way

THE MOST COMPLETE

GUARANTEE IN THE FLANGE & FITTING INDUSTRY

Take off and go fishing! — Your OTM flanges guarantee you trouble free performance — free from worry about flange failure. Specify OTM Blue Ribbon and relax!

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Your BLUE RIBBON GUARANTEE

Each OTM product is guaranteed to be free from manufacturing defects. If failure occurs within one year after shipment, any OTM product will be replaced without charge when the following conditions have been met:

Provided it has been used as recommended and within A.S.A. and A.G.A. specifications and in accordance with recognized practices.

When the product is to be welded, provided it has been welded in accordance with recognized practices and within such Standards as A.S.M.E. and A.W.S. Codes.

Provided it has not been worn out due to severe operating service, such as is encountered under extremely corrosive, abrasive or acid conditions which the steel was not made to withstand.

OTM Corporation will pay all transportation charges and any necessary expense incurred to remove and replace any OTM product proved to be defective.

This is the broadest and most specific guarantee in the industry. You are CERTAIN of the superior performance of BLUE RIBBON PRODUCTS!

If you believe any OTM product to be defective, regardless of how minor the problem may be, call Mr. Kenneth H. Bradshaw collect (person to person) before making any final decision.

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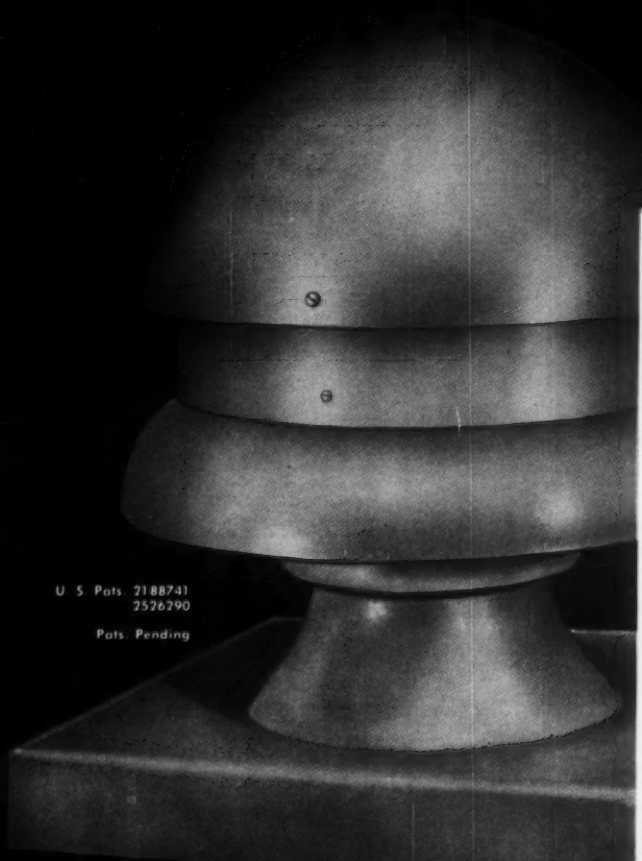
new SUPER/AIR-VAN®

in FIBERGLAS*



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New INTEGRATED DESIGN

obsoletes all previous standards for roof exhausters.

No important factor is neglected

INHERENTLY QUIET. For the first time a power roof exhauster is *actually* constructed of a *sound absorbing and dampening material.*

LIGHTWEIGHT! GREAT STRENGTH! Structurally equal to steel, yet far lighter. Less subject to vibration. Much greater impact strength than aluminum or steel. Lightweight also means new economies in both shipping and installation.

CORROSION RESISTANT. Uneffected by salt spray, common acids, greases, etc. *Never needs painting,* permanent color—a material that gives lifetime use without maintenance.

PATENTED SCROLL DESIGN assures efficiency. Static pressures to 4 inches.

MODERN LOW SILHOUETTE. Maximum curb 4". Unit (at left) delivers 1655 CFM of free air. Height only 25".

Write for new, detailed literature or contact one of our 60 representatives.

AMCA Seal does not apply to units with wheels of less than 12" diameter.

GALLAHER

20 Years of Leadership in Power Roof Exhauster Design

The Gallaher Company
4108 Dodge Street Omaha, Nebraska

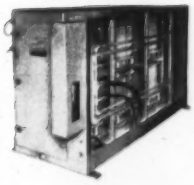
*TM Owens-Corning Fiberglas Corporation

To Specifiers and Users:

SUBJECT: 25% Price Reduction . . . *again!*

EFFECTIVE: August 1, 1958

APPLIES TO: Westinghouse Hi-Capacity Precipitron* Electronic Air Cleaning Equipment.



Model PG

Model PA

Model PF

REASON:

Westinghouse, the originator, is *first again* in reducing the cost of high-efficiency air cleaning as the result of continued research and improved engineering and manufacturing skills.

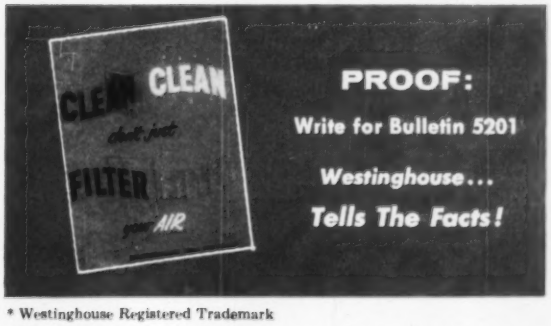
Hi-Capacity Electronic Air Cleaning was introduced by Westinghouse in early 1957 and initially priced 25% lower than any previous models. This is the *second 25% reduction across the board.*

USER BENEFIT:

Now you can CLEAN your air . . . not just Filter it . . . and readily justify the cost. Cleaning costs can be reduced 40% per square foot . . . first cost is now so low that no other air cleaning method can logically be considered.

. . . . . .

Fill in . . . and mail to: WESTINGHOUSE ELECTRIC CORP., STURTEVANT DIVISION, HYDE PARK, BOSTON 36, MASSACHUSETTS



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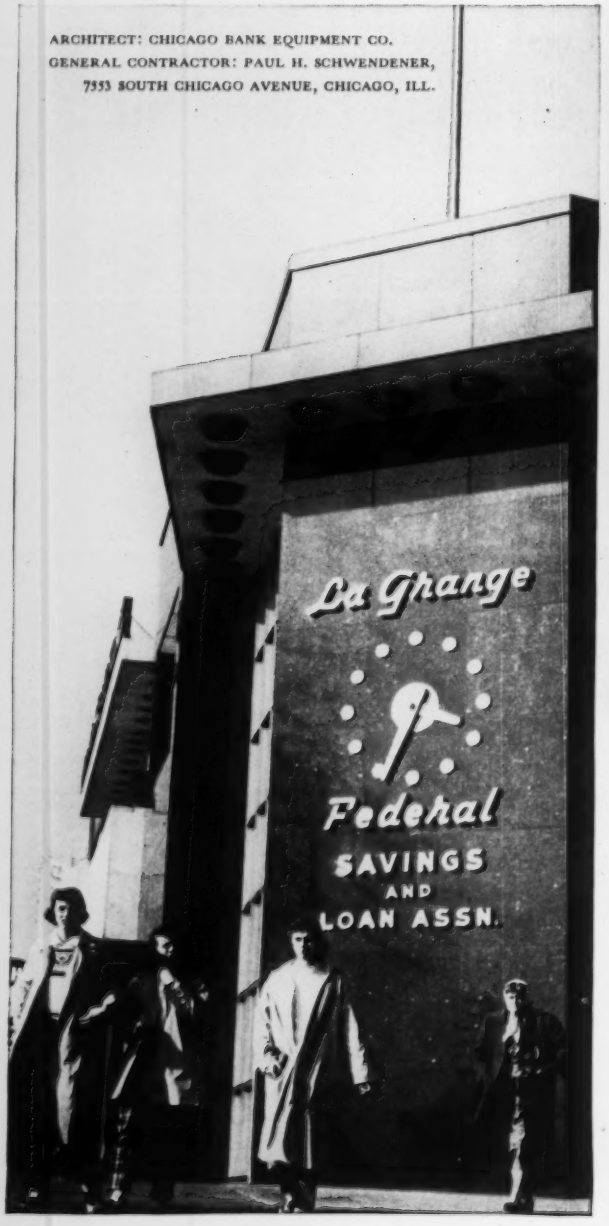
HPAC

* Westinghouse Registered Trademark

...now we're cooling

ARCHITECT: CHICAGO BANK EQUIPMENT CO.
GENERAL CONTRACTOR: PAUL H. SCHWENDENER,
7553 SOUTH CHICAGO AVENUE, CHICAGO, ILL.

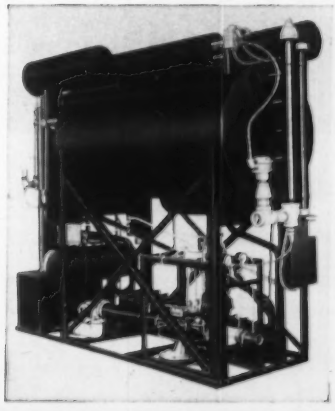


Specify Arkla-Servel Gas Air

With their new Arkla-Servel Gas Absorptive Cooler, the La Grange Federal Savings and Loan Association keeps customers cool in summer with the same compact system that keeps them warm in winter.

Before installing Gas, a complete study was made of available air conditioning systems. The Arkla-Servel unit—the only 25-ton absorptive cooler—was chosen because it is compact, easy to install, and costs are low for installation, operation and maintenance. No specially trained operating or maintenance personnel are required.

with GAS



Conditioning and you specify years of trouble-free comfort

Only Gas gives these important advantages:

- high efficiency at all times—even during the light loads
- temperature control is constant
- modular adjustment of capacity (instant automatic adjustment to match actual cooling requirements)
- dependability of fuel service at all times

Gas absorptive cooling can put your commercial and industrial clients' heating plant on a year around paying basis. It utilizes low pressure steam to cool water, has no moving parts to wear out, and provides quiet, economical operation. What's more, it's vibration-free.

Take advantage of the consulting services provided by your Gas company. They have trained specialists who have been working with contractors and builders for years. They belong to your associations or affiliations and are familiar with your problems. Check the facts about Gas and you'll see modern Gas air conditioning out-performs all other fuels. *American Gas Association.*

ARE YOU PAYING HIGHER

Check these HIDDEN COSTS in

In figuring the cost of air conditioning and heating equipment, there's only one cost that counts—*installed cost.* Installed cost includes all the *hidden, extra costs of completing the job.*

Equipment bought on low delivered price often costs more *installed* than quality Kennard equipment. Why? Because Kennard equipment is engineered to eliminate the hidden costs . . . the extra labor and materials needed to complete the job. Kennard design and construction features make the difference. Many of these quality features that help cut hidden costs and give more satisfactory service are *exclusive* with Kennard, and they're standard, at no extra cost.

An ever-growing number of contractors have learned, from actual experience, how Kennard equipment can eliminate or reduce many hidden installation costs. Job after job has proved it to them. Their sub-contractors and their own craftsmen—familiar with all brands of equipment—have helped show them the installed cost savings that Kennard equipment makes possible.

Let your own experience prove that Kennard quality can actually cost less. Just check the list of common hidden costs against your own recent jobs using equipment bought on *low price.* Then, check the Kennard quality features that can cut those hidden costs to give lower *installed cost.*

On your next job, figure the cost of equipment in installed cost, *the only cost that counts,* rather than on delivered price. Your local Kennard Representative will help show you how to profit from quality. He'll give you information, too, on new units that make the Kennard line of air conditioning and heating equipment even more complete.

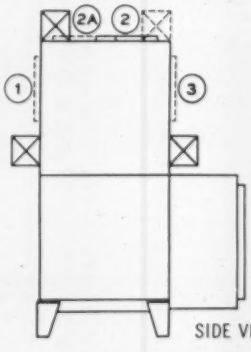
Representatives In All Principal Cities

☐ **DUCTWORK**
Extra ductwork, elbows and turns required by limited choice, or no choice, of blower air intake positions and unit arrangements.

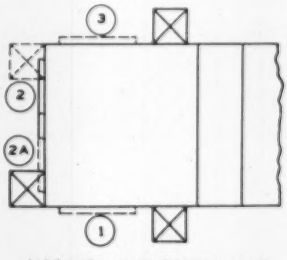
☐ **DAMAGE**
Extra cost of repairing handling damage—ruined insulation, air leaks, dents—when panels are large and flimsy.

Here's why KENNARD

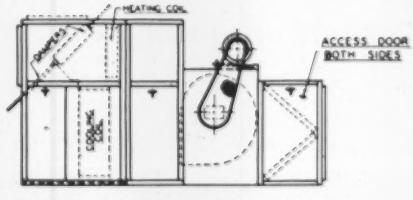
CHOICE OF DISCHARGE AND MOTOR POSITIONS



SIDE VIEW—VERTICAL UNIT



SIDE VIEW—HORIZONTAL UNIT



SIDE VIEW—HORIZONTAL MULTI-ZONE UNIT

Kennard units offer a cost-saving choice of lower discharge and air intake positions, and unit arrangements. These choices of vertical or horizontal positions, to match risers and laterals, eliminate elbows, shorten ducts, reduce duct resistance, solve space problems. Choice of motor positions, too, helps cut installation costs, particularly in crowded equipment rooms.

KENNARD
ST. LOUIS 14,

PRICES FOR LOWER QUALITY

YOUR Air Conditioning and Heating Jobs...

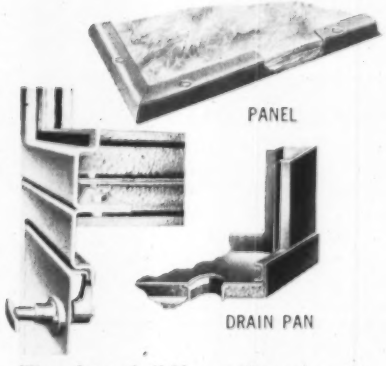
☐ **HOISTING-RIGGING**
Extra cost of handling units not rigidly framed and not having separate, self-supporting sections.

☐ **ASSEMBLY**
Extra labor to complete the factory's assembly; re-working to get proper fit-up of mating surfaces; extra piping.

☐ **DELIVERY**
Extra cost of delivery delays—stand-by and overtime pay; cost of holding up other work.

☐ **CALLBACKS**
Extra cost of correcting troubles where quality was ignored to "get under the wire" on price.

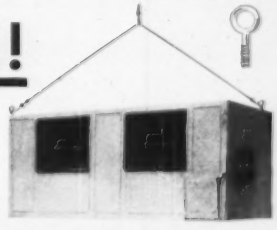
QUALITY Costs Less Installed!

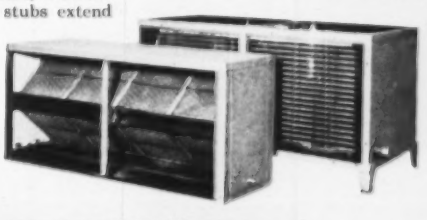


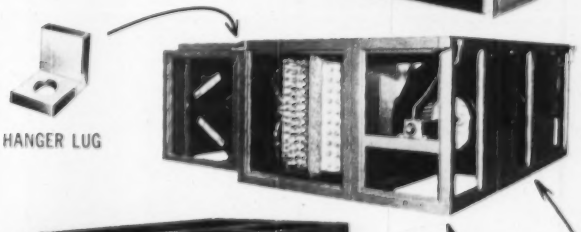
The edges of all Kennard panels are double flanged to provide rigidity and a protective covering over the edge of the insulation. Drain pan insulation is protected by *double pan* construction, with the insulation sealed *between* the inner and outer pans.

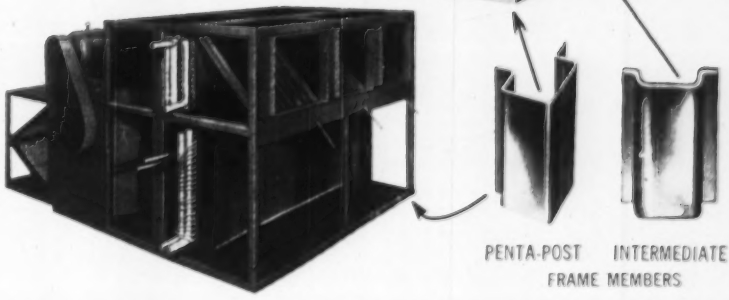
Kennard's strong, rigid, welded frames, featuring PENTA-POST construction, give maximum strength with minimum weight. Hanger lugs on suspended units, and lifting eyes on vertical units, simplify hoisting. Self-supporting sections handle easily, move through small openings, won't buckle out of alignment during hoisting and rigging. For every type of installation —suspended, floor mounted, equipment room, roof—Kennard equipment is designed for easier, lower-cost installation.

Kennard units are sectionalized for easier handling, more flexible arrangement, but each section assembly is complete—not knocked down. Mating faces are precision manufactured, bolt together quickly and easily, require no re-working. Thermal expansion valves are factory installed inside the unit, with the liquid line piped to the outside. Coil stubs extend outside the cabinet for easy piping connection, and are grommeted to prevent air leakage. Panels and doors are easily removable to give workmen full access to all parts of the units, regardless of installed position and crowded conditions.









DELIVERY: Kennard's reputation for on-time delivery is carefully guarded and backed up with reliable production schedules. In Kennard's larger, all-new factory, with doubled production capacity, your orders will be manufactured in the shortest possible time, under rigid quality control. Kennard can, and does, give special attention and faster shipping schedules whenever a job is progressing more rapidly than anticipated and the contractor needs the equipment earlier.

CORPORATION

MISSOURI

College puts

coal at head of class

Otterbein College saves 42% with coal, installs revolutionary package boiler

Otterbein College, Westerville, Ohio, has discovered truly efficient heat generation. Otterbein's new heating plant burns coal in Coal-Pak boilers—developed by Bituminous Coal Research, Inc.—for automatic performance plus unique simplicity of operation. The result . . . savings in manpower . . . and a spotlessly clean plant.

In addition, comparative fuel cost studies have proved that coal costs 42% less per million Btu than the nearest competitive fuel in this area . . . a bonus savings! And, in keeping with the modern operation of this plant, the entire interior has been brightened by an attractive color scheme.

Facts you should know about coal

You'll find that bituminous coal is not only the lowest-cost fuel in most industrial areas but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment can pare labor costs and eliminate smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

Technical advisory service

To help you with industrial fuel problems the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to the address below. Or send for our case history booklet, complete with data sheets. You'll find it informative.

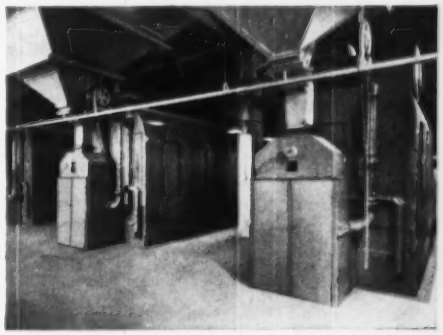
Consult an engineering firm

If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you in efficiency and fuel economy over the years.

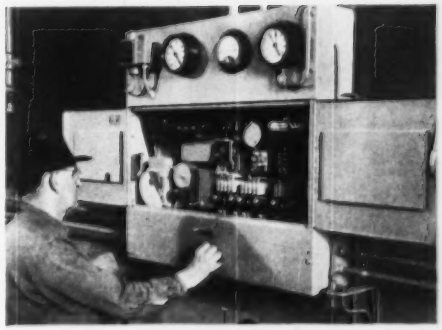
BITUMINOUS COAL INSTITUTE

Department HP-08

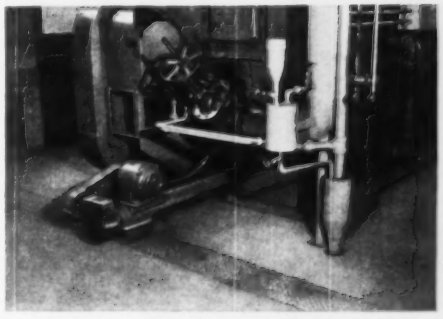
Southern Building • Washington 5, D. C.



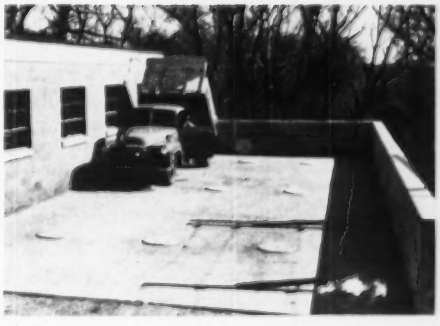
Heating plant at Otterbein showing the three Coal-Pak Automatic Water Tube Generators, by International Boiler Works Co. (Licensed under pending patents of Bituminous Coal Research, Inc.) Coal storage hoppers at top of photograph hold 30-35 tons of coal each.



Single switch on front of cabinet enables operator to change from "run" to "hold-fire" operations. Each generator has its own rugged, non-electronic combustion control system, housed in tamper-proof locked cabinet. It controls safely and efficiently the starting-up sequence, coal feed, fuel-air ratio, hold-fire operation and ash removal.



Rear of generator, showing part of dustless ash disposal system. Ash removal is an integrated feature of the package operation—no manual handling. Ashes are removed by screw conveyor. They pass into main screw conveyor recessed into the floor (covered by metal plate) and are carried outside.



Coal is delivered by truck and dumped through any of nine manholes into storage hoppers below. From hoppers, it is gravity fed into stokers. Four-foot wall around coal dumping platform permits use of platform for outside coal storage, holding additional 250 tons.

"WE SECURED EVEN TEMPERATURES THROUGHOUT THIS 14-STORY BUILDING WITH SARCOTHERM HEATING SYSTEM CONTROLS,"

say Slingerland and Booss, architects and engineers

New York's "Avon House," completed in 1957. Architects and Engineers: Slingerland and Booss, 120 Greenwich Street, N. Y. C.

Mechanical Contractors: Fein-Schlosberg, Inc., 1770 Second Avenue, N. Y. C. Owner: The Ten Men Realty Co., Leon Finley, President, N. Y. C.

In the superbly appointed "Avon House" apartments at 340 East 74th Street, New York, the complete automatic heating control job is Sarcotherm. The architects and engineers, Slingerland and Booss, called on Sarco's experienced engineering department to work with them and the mechanical contractor in working out components—controls, vacuum pumps and steam specialties. Besides setting up undivided responsibility of one manufacturer, this policy assured a balanced system with no weak links.

Accurate orifice calculations by Sarcotherm insured proper distribution of subatmospheric steam in the system, even in mild weather. Each of the 2 zones of this building is controlled by a Sarcotherm Continuous Flow Modulating Steam Control Valve. These valves meter the steam to furnish proper heat at any given outside temperature. Control Valves are influenced by outside temperature, wind velocity, and solar radiation, plus differential steam pressure between supply and return mains. A Master Control Panel supplies complete programming operation with automatic control for day, night and morning pickup cycles.

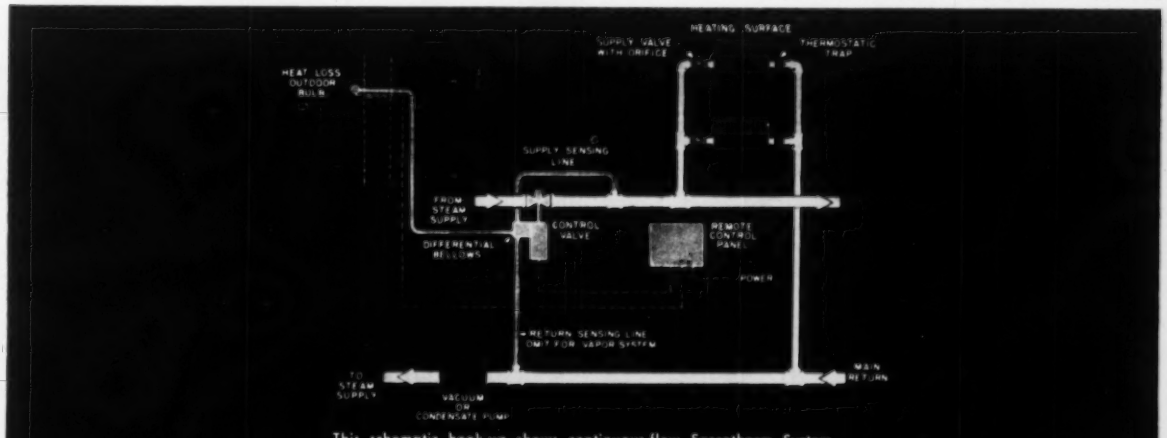
There is ample testimony to the sound judgment of the architects in making this a complete Sarcotherm vacuum heating control system. Since its first day of operation the installation at the new Avon House has been 100% trouble-free.

SARCOTHERM

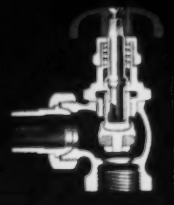
An Affiliate of SARCO Co., Inc.

635 Madison Avenue, New York 22, N. Y.

"INSTALLATION WAS EASY, THANKS TO SARCOTHERM ENGINEERING SERVICE AND UNDIVIDED RESPONSIBILITY FOR CONTROLS, SPECIALTIES, PUMPS," *say Fein-Schlosberg, Inc., mechanical contractors*

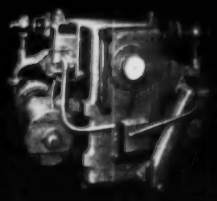


This schematic hook-up shows continuous-flow Sarcotherm System



Sarco No. 1141 Spring-Packless Steam Radiator Valves, Type H Radiator Traps and Type FT Float-Thermostatic Steam Traps are used.

This WFA-X6 Control Panel has supply and return pressure gauges.



DVA Duplex Vacuum Pump is furnished complete with magnetic starters, float switch and vacuum regulator.

Marked advantages were found by the mechanical contractors in the quality of orifice engineering provided by Sarcotherm. Every valve, for example, was calibrated and the orifice plate brazed in at the factory. All units were tagged, unit-packaged, and keyed in with the hook-up drawing. The installation was supervised by Sarcotherm engineers. The installation was rapid and easy. No on-the-job adjustments were necessary.

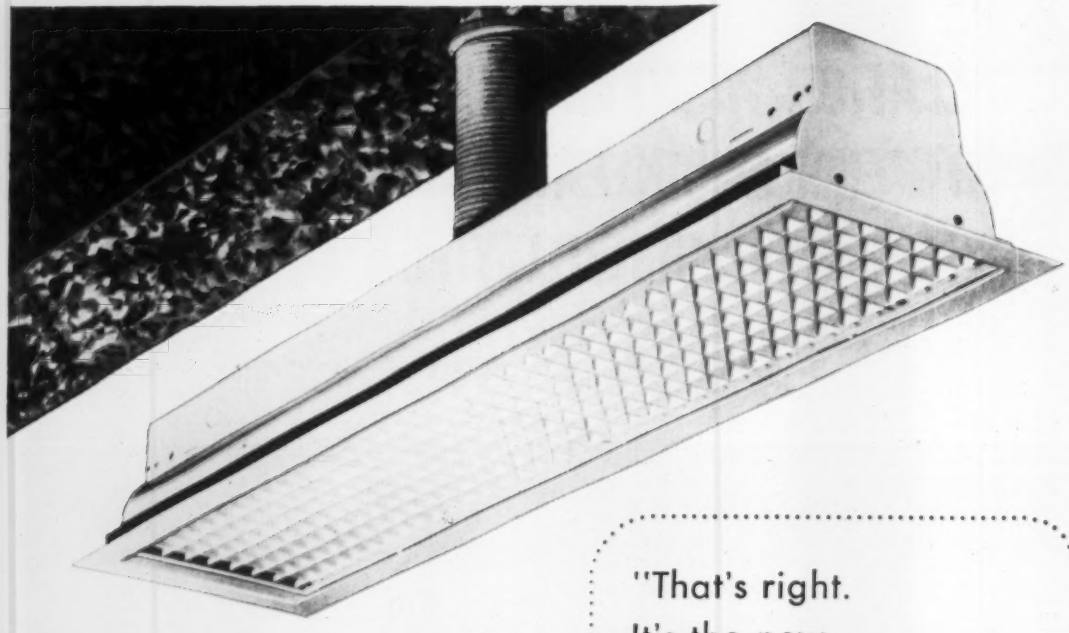
SARCOTHERM

An Affiliate of SARCO Co., Inc.

*

FOR COMPLETE CONTROL SYSTEM CATALOG:
write Sarcotherm Controls, Inc.,
635 Madison Ave., New York 22, N. Y.

6176 B



"That's right.
It's the new
MULTI-VENT TROFFER
The air diffuser
is completely concealed
in the flush light fixture!"

"You mean you get
both air *and* light
from the same unit?"

There's more to the new **MULTI-VENT TROFFER** than meets the eye!

It combines a great advance in gently diffused, draft-free air conditioning, with modern, highly efficient lighting at a substantial savings in cost!

Complete concealment of the air diffuser within the handsome light fixture means freedom for the architect to design clean, uncluttered ceilings, greatly simplified mechanical planning for the engineer and . . . for the contractor . . . faster, easier field installation.

Write for detailed literature and the name of the representative in your area.

multi-vent

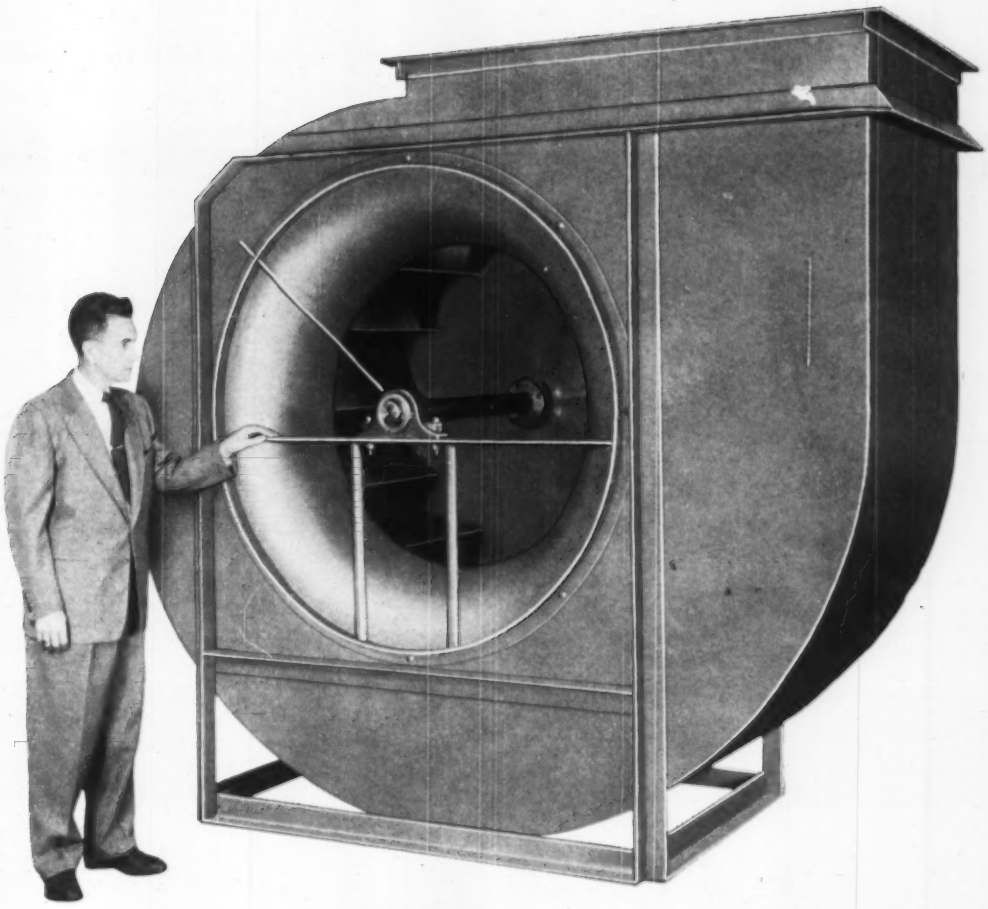
DIVISION OF
THE PYLE-NATIONAL COMPANY

1373 N. Kostner Avenue, Chicago 51, Illinois

WHERE QUALITY IS TRADITIONAL

Multi-Vent® by The Pyle-National Company—Trofferlite by Benjamin Electric Mfg. Co.

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA



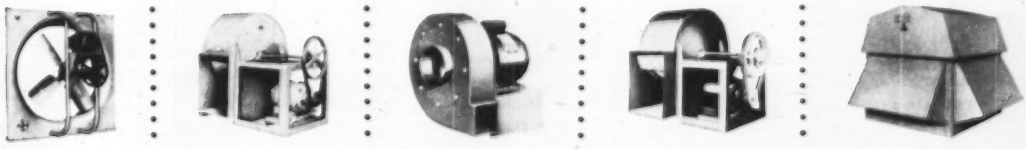
BIG BLOWERS ARE BIG BUSINESS WITH PEERLESS

QUIET! • TROUBLE-FREE! • DEPENDABLE! • HEAVY DUTY! • GUARANTEED!

Versatility in size, application, and engineering has always been a Peerless strong point. Peerless builds its own motors and matches them to the specified blower requirements. Peerless blower frames and housings are usually heavier than any competitive products. Result—a quiet, vibration-free unit.

These are not "off-the-shelf" units, but built to customer rotation and discharge specifications. Each one receives 100% inspection before it leaves the Peerless factory. Each unit is built to NAFM standards. Motors are built to NEMA standards. Each unit is ready for operation when received at the installation site.

A COMPLETE LINE OF AIR MOVING EQUIPMENT



See our Catalog in Sweets

Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless Electric

FAN AND BLOWER DIVISION

THE *Peerless-Electric*® COMPANY

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FANS • BLOWERS • ELECTRIC MOTORS • ELECTRONIC EQUIPMENT

Write Today for Bulletins SDA-220, SDA-200 and SDA-160.

News about

B.F.Goodrich Chemical *raw materials*

the pipe is made of Geon
handles salt water under pressure: *no corrosion*

NO pipe replacement problem will plague the owners of this Florida air conditioning installation. If ordinary pipe had been used, the corrosive effect of salt water under pressure would soon show up in high replacement costs. But pipe made from Geon rigid vinyl handles the job easily—and permanently. It is not affected by salt water. No galvanic corrosion problem either.

Geon vinyl pipe more than pays its way wherever corrosion is the problem. Installation crews like it, too, because it is lightweight and easy to handle. Can be readily joined by solvent welding.

How can you take advantage of pipe made from Geon rigid vinyl? Get information by writing Dept. LW-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

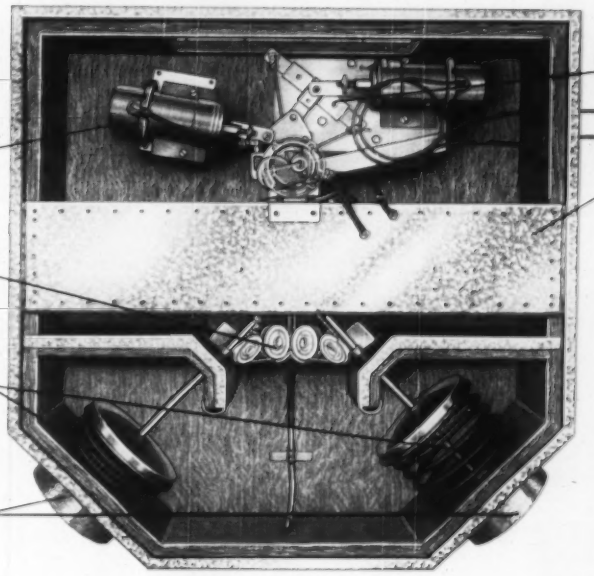
B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

7 ENGINEERING REASONS Why

TO SPECIFY NEW CONNOR KNO-DRAFT HIGH VELOCITY VALVE ATTENUATORS


1 CONSTANT VOLUME CONTROL
2 HIGH QUALITY COMPONENTS
3 PATENTED HELICAL NEOPRENE SPRING DAMPERS
4 45° INLETS
5 UNITIZED LINKAGE MECHANISM
6 CHOICE OF SOUND BAFFLES
7 MODELS FOR EVERY REQUIREMENT

SHOWN HERE are seven sound reasons why new Kno-draft "Series 45" Valve Attenuators meet every test of high velocity systems . . . assuring better balanced air delivery and constantly controlled air diffusion.

CONSTANT VOLUME CONTROL insures constant air volume despite static pressure fluctuations. Single adjustment of pressure regulator balances total air volume. All constant volume units use standard components of control manufacturers actuated by 15 psi air pressure.

HIGH QUALITY COMPONENTS: galvanized steel casing, vinyl coated acoustical absorbing material, nylon pulleys, stainless steel aircraft type cable.

PATENTED HELICAL NEOPRENE SPRING DAMPER positively assures complete close-off . . . full heating and cooling realized because damper shuts with less than 2% leakage.

45° INLETS mean fewer elbows required in take-off ducts, reducing static pressure losses and installation costs.

UNITIZED LINKAGE MECHANISM reduces friction, eliminates control lag, insures precise temperature regulation, permits easy servicing.

CHOICE OF SOUND BAFFLES: internal flat plate for quiet operation; patented sinuous baffle for use when maximum sound attenuation is demanded.

MODELS FOR EVERY REQUIREMENT: Open End, Diffuser, Integral Grille, Linear Diffuser, Under-Window.

The outstanding performance of the "Series 45" can only be matched by using its features.

CONNOR... for Constant Comfort Conditions

CONNOR ENGINEERING CORPORATION

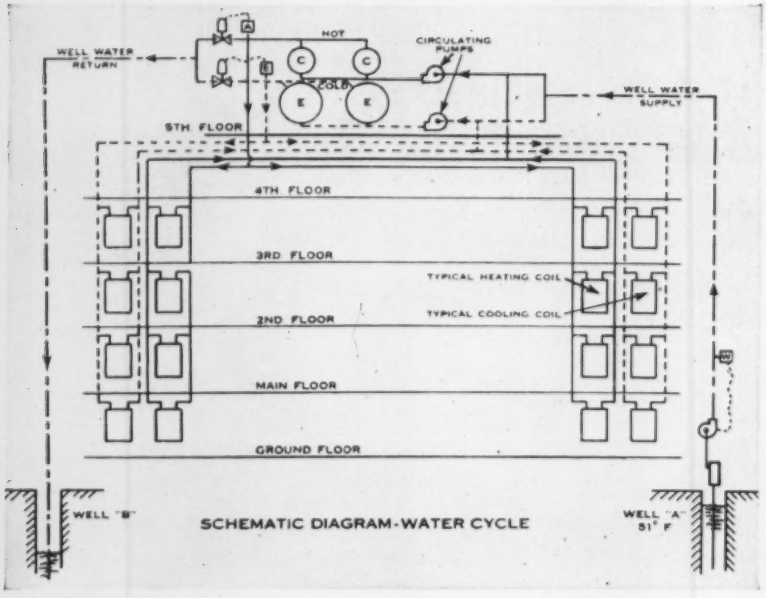
kno·draft®
high velocity air diffusers

CONNOR ENGINEERING CORPORATION

82 SHELTER ROCK ROAD • DANBURY • CONNECTICUT

Field reports about AIR CONDITIONING

Successful installations using Freon refrigerants*



SCHEMATIC DIAGRAM-WATER CYCLE

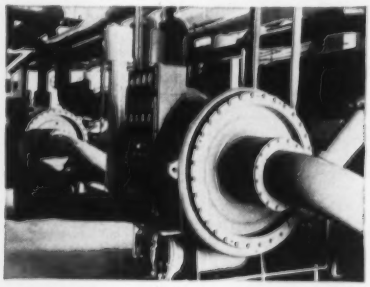
Circulating system uses feed-back principle to minimize water use under normal heating or cooling conditions

A unique feature of heat pump air conditioning for the Tacoma City Light Administration Building is the efficient use of available water supplies. Under moderate conditions heating loads virtually equal cooling loads. Under these conditions cooling side and heating side operate as closed circuits. For example, water returning from cooling coils is picked up and delivered to the evaporator unit. From there it passes to the supply side of the cooling coils. The same process goes on in the heating side. Outside water is needed only to maintain balance during more extreme heating or cooling conditions.

After one year of operation, this heat-pump system proved to be most efficient and economical for use throughout the year.

Favorable power rates, balanced heating and cooling loads justify heat-pump installation

When seasonal heating and cooling loads are approximately equal, a heat pump can be the most economical way to condition a large building. This was especially true at the Tacoma City Light Administration Building, Tacoma, Washington, because low-cost electrical power and water were available at the building site. Initial cost of the heat pump was higher than conventional systems, but combined heating and cooling operating cost is actually one-third less than the operating cost of another system of comparable size supplying only heat.



The heat-pump system consists of two 150-ton Trane CenTraVac units (shown above), which heat or cool water as required for distribution to coils on each floor. Water cycle (shown at left) is designed to use very little well water under moderate conditions. A roof-mounted fan unit delivers 150,000 cfm of filtered air to the system.

The refrigerating system is charged with "Freon-113" refrigerant, chosen because of its proven safety, over-all economy and trouble-free performance.

How Du Pont leadership in refrigerants means better performance for installations you plan

Today's more compact, more efficient equipment has grown in part from Du Pont's pioneering in development and manufacture of improved "Freon" refrigerants. Improved manufacturing techniques developed by Du Pont make "Freon" the refrigerant that sets the industry's standards for purity and performance. That's why you can be sure the installations you plan will deliver better performance when charged with "Freon". You can't select a better refrigerant than safe, acid-free, dry "Freon" refrigerant.

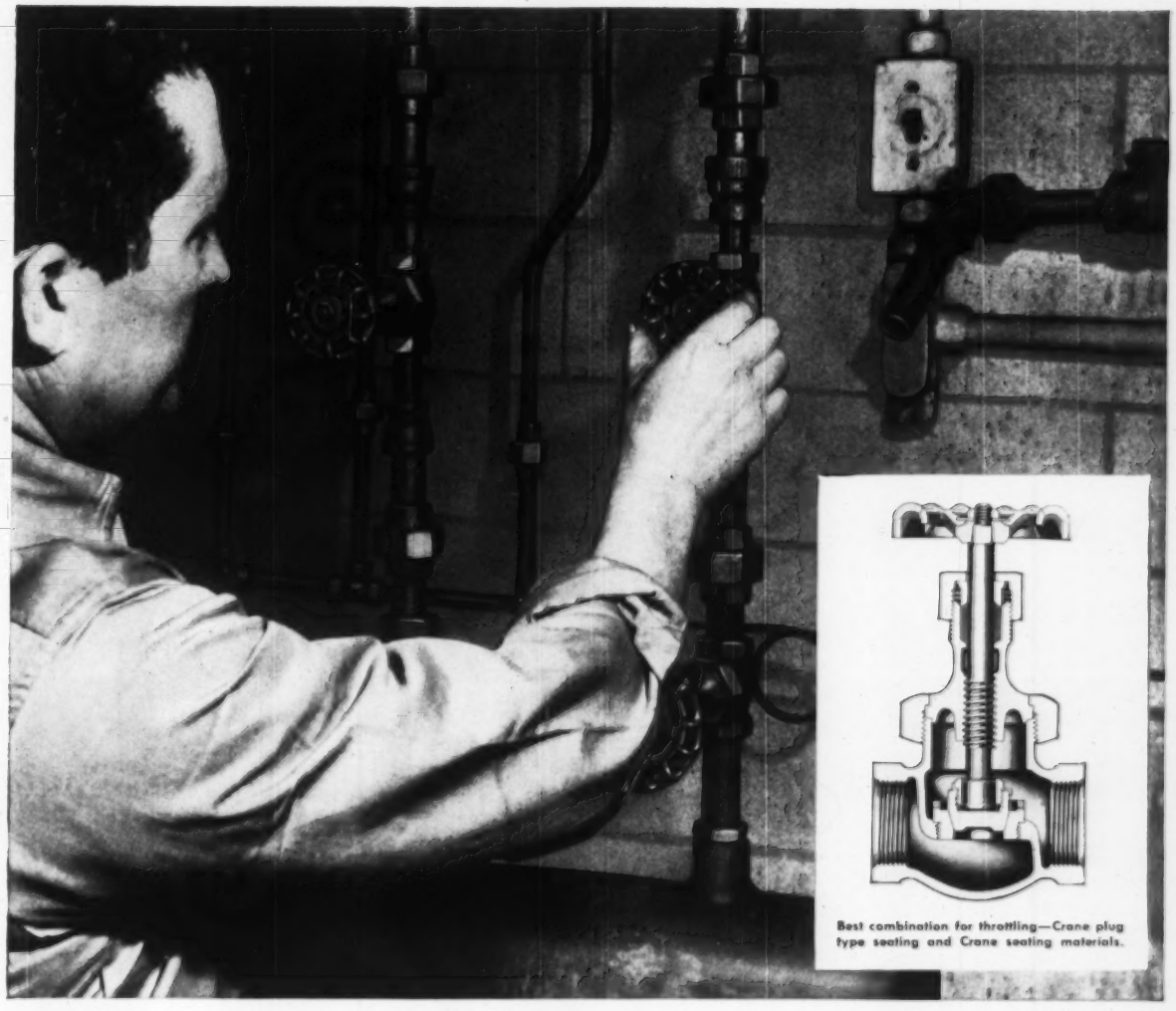
For complete information on applications, performance and properties of "Freon", write: *E. I. du Pont de Nemours & Co. (Inc.), "Freon" Products Division 138, Wilmington 98, Delaware.*

SALES AGENTS: ANSUL CHEMICAL CO., MARINETTE, WISCONSIN; AND VIRGINIA SMELTING CO., WEST NORFOLK, VIRGINIA

FREON® **REFRIGERANTS**

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

**Freon and combinations of Freon- or F- followed by numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.*



Best combination for throttling—Crane plug type seating and Crane seating materials.

Surprising savings for this power plant with Crane bronze throttling valves

At least once a year, this power plant of a leading machine tool builder was replacing the valves in the ½-inch continuous blowdown lines on its 60,000-pound boiler.

They were high-priced valves, but they couldn't take the continual throttling service. The seats cut out rapidly . . . blowdown regulation was lost . . . valve costs kept rising.

Thirty-one months ago this plant replaced the short-lived valves with Crane No. 212P, 200-pound bronze globe valves with plug type disc. Most of the time these Crane valves have been operating at less than half-open.

Yet, at every inspection to date, they've been found O.K.—no seat damage . . . no loss of regulation . . . no maintenance needed. Another proof of the economy of Crane quality!

To cut your valve and piping maintenance costs—on steam or any fluid—call in your local Crane Man. He has more to offer in money-saving piping materials.

COST-SAVING IDEAS FOR YOU in this free 36-page book of "Valve Performance Facts." Get your copy from your Crane Man or write to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

When piping changes direction, protect process equipment with

ZALLEA SELF EQUALIZING UNIVERSAL EXPANSION JOINTS

Zallea Self Equalizing Universal Expansion Joints absorb any movement in any direction . . . axially, laterally, angularly, or any combination of these . . . making them ideal for protecting process vessels and rotating equipment from thermal expansion of connected piping.

When there is a leg or 90° offset to a long run of pipe, one Zallea Universal Expansion Joint will frequently take care of the entire system.

Under conditions of low load requirement for anchors or equipment . . . or when compressive loading in pipe walls must be kept to a minimum . . . Zallea Universal Expansion Joints are the most economical answer to the problem. They absorb the internal pressure thrust. The piping system need only carry the relatively small deflection loads.

Many types of Zallea Tied Expansion Joints are designed especially to absorb lateral deflection or rotation when there is pressure in the line. Universal, Modified Universal, Hinged, Gimbal, Pressure Balanced and Universal Pressure Balanced Expansion Joints give you a choice of the type best suited to your particular application.

Get the complete story of Zallea Expansion Joints in our new 72-page manual. Write, on your company letterhead, for your copy of Catalog 56. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

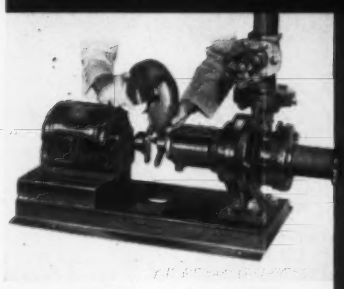
Zallea
expansion joints

Zallea Brothers • Wilmington 99, Delaware

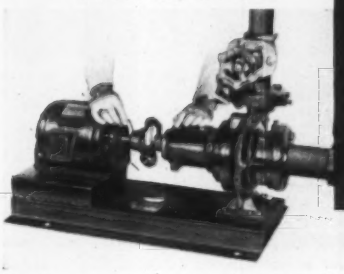
World's largest manufacturer of expansion joints

24" dia. Zallea Universal Self Equalizing Expansion Joints in service lines of the engine test facility of a West Coast aircraft manufacturer.

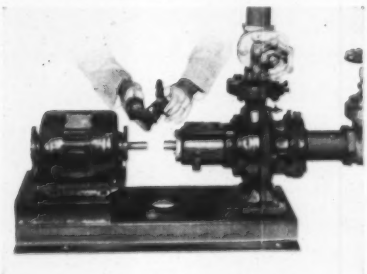
EASY TO SERVICE
... no pipes to disconnect



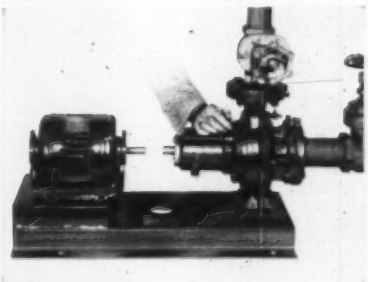
Remove coupler shield



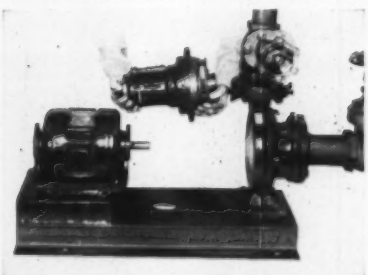
Loosen coupler set screws



Slide coupler off the shafts



Remove volute cover cap screws



Lift out entire bearing frame and impeller

B & G UNIVERSAL PUMP
...featuring vertical split case design

DESIGNED FOR WHISPER-QUIET VIBRATIONLESS OPERATION

No feature is so important in a circulated water heating or cooling system pump as *quiet operation!* Transmission of pump noise through the piping can ruin the most carefully installed system.

B&G Universal Pumps meet this challenge. They are engineered and built to satisfy in every detail the exacting demands of circulated water heating and cooling systems...distinguished by numerous features which assure silent, vibrationless operation.

Universal Pump motors, for example, are specially constructed and selected for *extra-quiet* operation. Long *sleeve* bearings are used in both motor and pump—another assurance of silent, vibrationless operation and long life of both pump and motor. The oversized shaft is made of special alloy steel, with an integral, heat-treated thrust collar to absorb end-thrust. Water leakage is prevented by the diamond-hard "Remite" mechanical seal...a B&G development.

Note, too, how *vertical* split case construction with removable bearing frame permits easy servicing without breaking pipe connections.

"PD" BOOSTER
Largest in-line Booster

B&G BOOSTER

B&G Booster pumps are in-line units with the same features which distinguish the Universal Pump. *Nearly 3,000,000 have been installed!*

Reg. U.S. Pat. Off.

BELL & GOSSETT
COMPANY
Dept. FJ-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

T F

Precision Press Forgings (as well as Hammer Forgings and Extrusions) are made in quantity on a production basis as missile, rocket and engine components, heavy machinery parts, etc. This 64¾" OD x 1½" wall thickness press-forged stainless steel part is a Heat Sink for a long range missile.

TAYLOR

This 42" OD x 16" long Stainless Steel Jet Engine Turbine Case is representative of products formed by Taylor Forge ring rolling methods. Seamless rings are made in sizes to 120" OD with practically any required section.

Forged Headers with contoured outlets, made with any required outlet arrangement, are widely used for valve settings, gas compressor station manifolds, scraper traps, refinery charge heater headers, and many other applications in gas, oil and process piping. They are also made in heavy wall thicknesses for high pressure-temperature central power station service.

Electric Fusion Welded Pipe is made in sizes from 14" OD to 96" OD with wall thicknesses to 1.531", and in a variety of materials (including stainless and alloy steels). This pipe offers many opportunities for substantial economies, particularly in high pressure-temperature services and also in pipeline river crossings and other applications involving special design requirements. Pipe pictured is 16" OD x 1" wall thickness and is stainless steel.

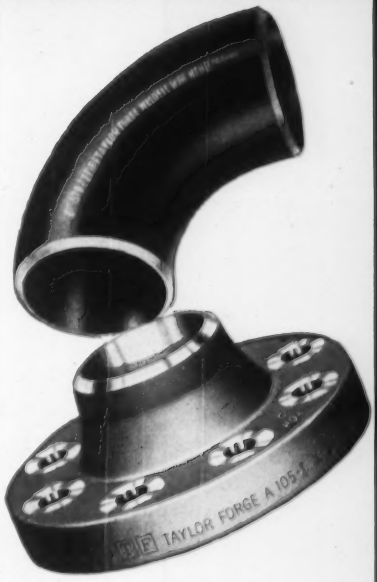
SERVING INDUSTRY with many essential products

FORGE

Traditionally Dependable

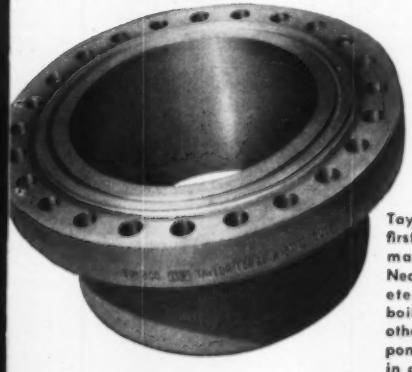
Perhaps you think of Taylor Forge only as a maker of highest quality Welding Fittings and Forged Flanges—and certainly they are most important lines with us. But Taylor Forge is also an outstanding producer of many other less widely known though equally essential products.

The few examples pictured here are representative of the many diverse parts made by Taylor Forge to serve American Industry. One thing they have in common is the dependability, the integrity, that has always been associated with the name TAYLOR FORGE.



Taylor Forge & Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois
Plants at: Carnegie, Pa., Gary, Ind., Houston, Texas, Fontana, Calif., Hamilton, Ont., Canada
District Sales Offices: New York, Boston, Philadelphia, Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles, San Francisco, Seattle, Toronto, Calgary, Montreal.



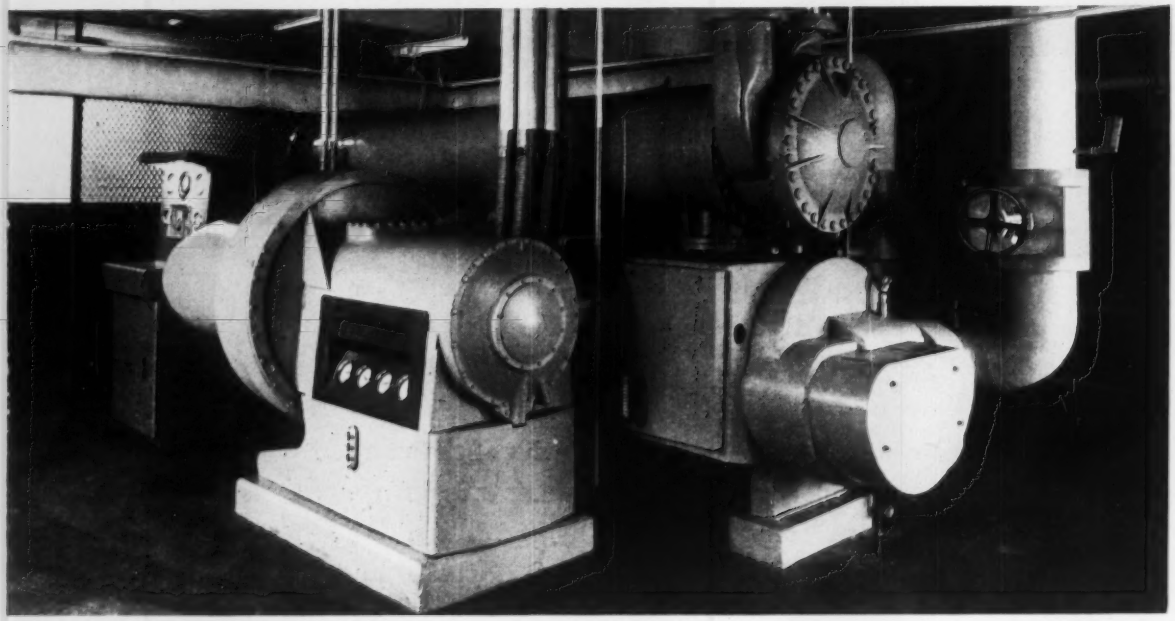
Taylor Forge was America's first and is still the foremost manufacturer of Welding Necks, Nozzles, Large Diameter Flanges and similar boiler, heat exchanger and other pressure vessel components. Such parts are made in any size and material for any service condition.

Spiral-Weld Pipe, our original product, (first made as spiral riveted pipe nearly 60 years ago), remains to this day a major item and its use continues to expand. Its money saving features are widely recognized in services such as gas gathering lines; gas, oil and water well casing; irrigation pipe; water piping in sand, gravel and mining operations; and in fact, wherever the use of light weight pipe is indicated. It is also widely used as pipe piling.

Carrier Hermetic Centrifugal Refrigerating Machines

now in a complete range of sizes

90 to 1100 tons



Carrier Hermetic Centrifugal Machines are available in a wide range of capacities in each size, with a choice of motor horsepowers and voltages, to meet the most exacting refrigeration load requirements in air conditioning and process cooling applications. In addition to economical selection with performance matched to specific job conditions, the Carrier Hermetic Centrifugal offers important advantages:

It combines weight savings, space savings and efficiency better than ever before achieved in a large refrigerating machine.

It runs smoothly and quietly; can be located on the roof of a building or in the basement without a heavy or costly foundation.

It operates economically. Capacity and power input are adjusted to the load, continuously, by inlet capacity vanes that are positioned, as required, by the hydraulic pressure of the lubricating oil.

It is automatic. After simple push-button starting, electronic controls provide continuous, automatic chilling of water to the desired temperature.

It has mechanical simplicity. The motor-compressor unit, hermetically sealed against air, moisture and refrigerant loss, is factory assembled on a single shaft.

Whatever your refrigeration requirements, there is a Carrier specialist in your area to assist you with the selection.

For detailed information about the Carrier Hermetic Centrifugal Machines, just call the Carrier district or branch office nearest you, or write to us at Carrier Corporation, Syracuse, New York.

Carrier air conditioning · refrigeration · industrial heating

SPECIFY COPPER TUBE AND PIPE MADE THE QUALITY WAY...

MADE IN U.S.A.

BECAUSE:

- You are assured of *consistent* quality time after time.
- You support your fellow American workers.
- You help build your reputation and America's prosperity.
- You can count on a reliable source of supply.

TYPES K, L, M, DWV, COPPER AND BRASS PIPE

The All-American Line From Mine to Market

PHELPS DODGE COPPER WATER TUBE

- Highest grade copper from Phelps Dodge's own mines.
- Controlled quality assures unsurpassed tube properties, including precise uniformity of wall thickness.
- Color-coding of straight-length tubes for instant identification.
- Packaging that's easy to stock, easy to use.
- Mill depots strategically located for speedy service.

Quality tube sold the Quality way—through wholesalers

PHELPS DODGE COPPER PRODUCTS CORPORATION

NEW YORK, N. Y. • LOS ANGELES, CALIF.

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

ULTRALITE®

..the only duct liner made exclusively of strong textile-type glass fibers...

"It will not pull apart under high vibration and high wind velocity conditions," says the Consulting Engineer who recently specified 15,000 ft. of Ultralite Duct Liner for one of America's outstanding new office buildings. "One of the major advantages of Ultralite liner over other forms is the long, fibrous structure which gives the material greater strength for retaining its structural shape."

Ultralite is the *only* glass fiber insulation made exclusively of long, strong, textile-type fibers. It's more rugged, more resilient—important advantages in duct systems continually subject to vibration and velocity. And easy-handling Ultralite offers exceptional acoustical and thermal efficiency, plus lower friction loss.

With all its advantages, Ultralite costs not a penny more. Specify Ultralite—and you get the ultimate in modern-day duct insulation and duct liner!

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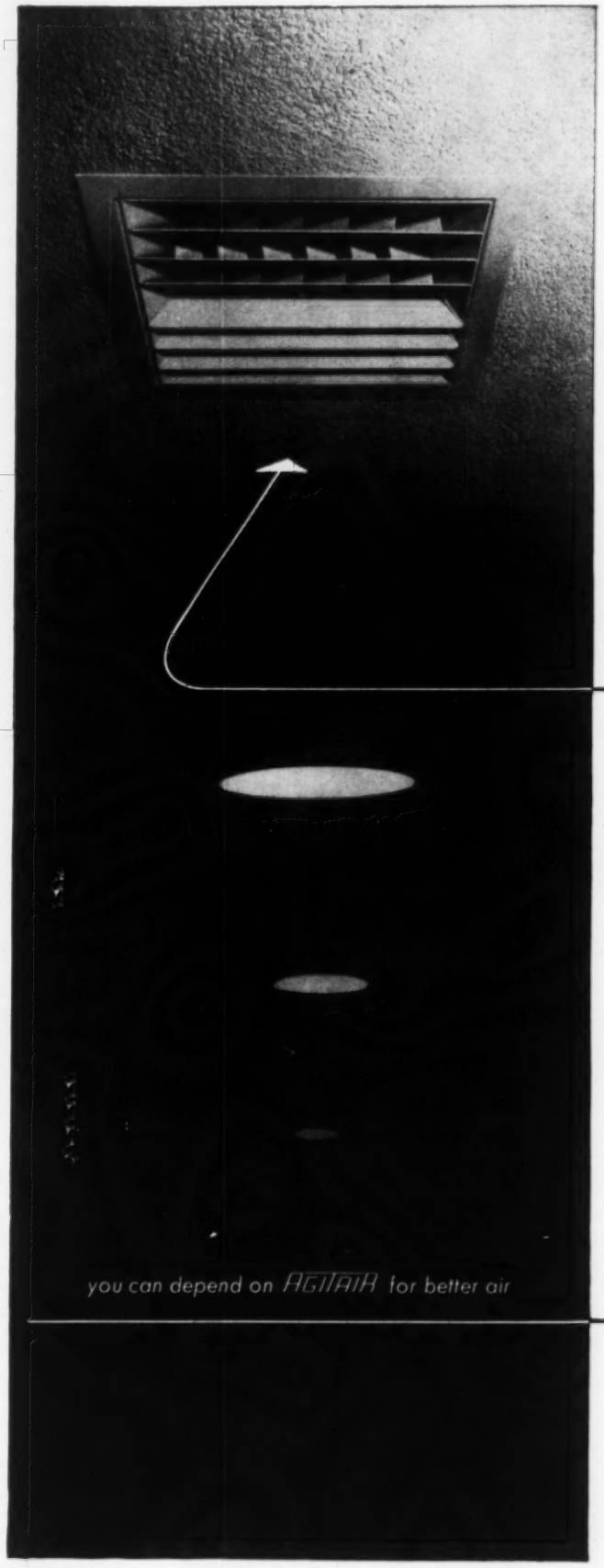


Custom Made

AIR DIFFUSERS with DIFFUSING VANES

Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.

These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.

AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.

Write for your copy today.

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

air diffusers • filters • exhausters

COPPER TUBE made light, fast work of an otherwise tough, slow job of roughing-in for two new baths on the second floor of a large old single-family house which was renovated to make several apartments.

Go after profits in remodeling with time-saving, space-saving, money-saving COPPER TUBE

"I've seen lots of copper tube installed and know how easily it handles, but in this remodeling job, copper really proved its worth," says a plumbing contractor's superintendent.

"With copper tube and solder-joint fittings, the overhead work necessary was no problem. But think what a back-breaking, time-consuming operation this would have been using heavier materials requiring threaded or caulked connections. And note all the space we saved—thanks to trim copper tube and compact fittings.

"I wish every architect, builder, and plumbing contractor who is skeptical about the value of all-copper plumbing could have seen this job go in. And copper has the same advantages in new construction, too."

Whether you are adding a single bathroom or renovating the plumbing in an entire house, copper tube and fittings can make your work easier and more profitable. Contractors report their installation time with copper is reduced one third to one half.

ROUGHING-IN for a bathroom on the third floor. Note small area of flooring removed—also that only small holes were needed in the old floor joists to install the copper tube waste line.

Anaconda Copper Tubes are available in all standard wall thicknesses—Types K, L, M, and DWV (Copper Drainage Tube)—through your plumbing wholesaler. See him also for Anaconda wrought copper and cast-brass solder-joint fittings.

For more information on ALL-COPPER plumbing, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

GMIG

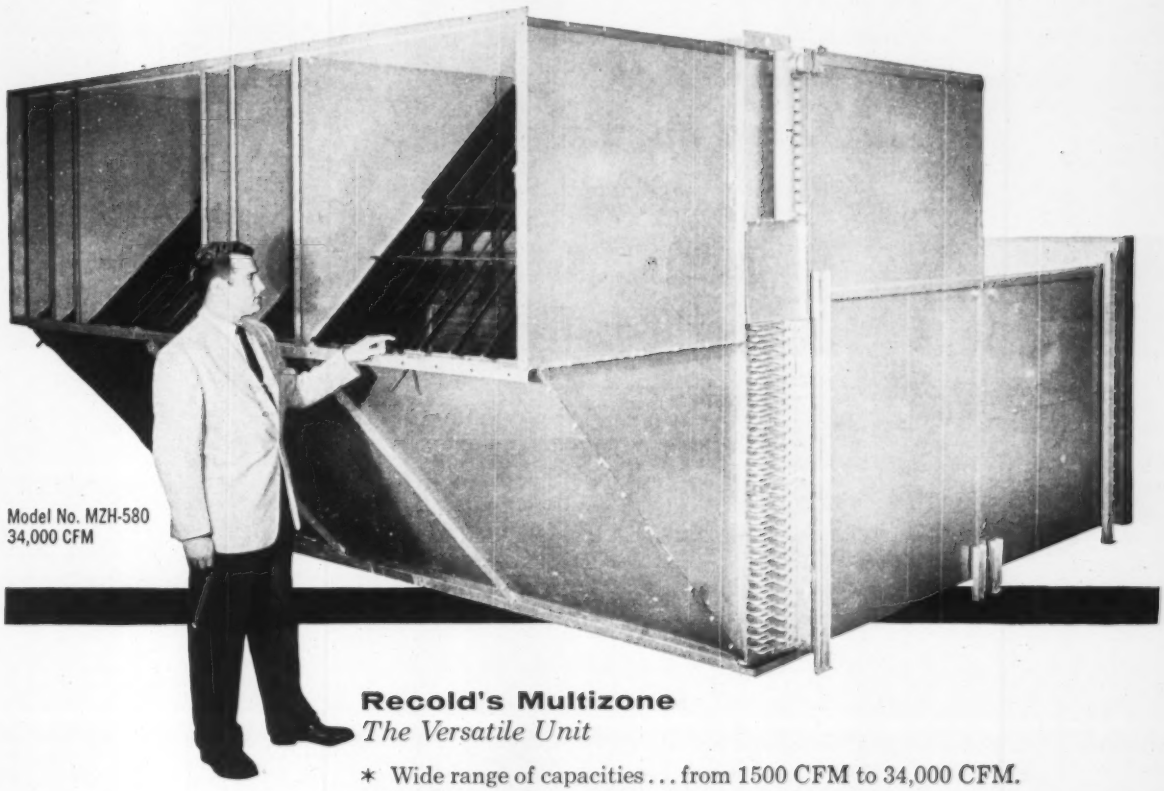
ANACONDA®

COPPER TUBES AND FITTINGS

Available Through Plumbing Wholesalers

For the Finest in Air Conditioning,
See the man who
represents

RECOLD



Model No. MZH-580
34,000 CFM

Recold's Multizone
The Versatile Unit

* Wide range of capacities . . . from 1500 CFM to 34,000 CFM.
* Available with vertical or horizontal discharge.
* Available with vertical or horizontal air intake.
* Large plenum chamber with air diffusers for best air distribution over cooling coil.
* Angle iron frame for rugged duty.
* Large slow speed blowers for quietness.
* Available with backward curved wheels.

For application in varied installations including:

Medical Suites
Office Buildings
Night Clubs
Insurance Buildings
Private Club Rooms
Hotels
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Factories
Department Stores
Schools

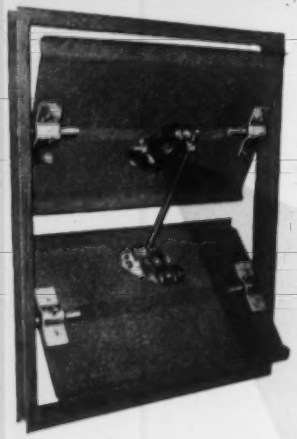
RECOLD 7250 East Slauson Avenue, Los Angeles 22, California

Complete line of Air Conditioning Coils, Evaporative Condensers and Air Handling Units.

DURO DYNE

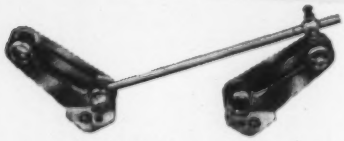
NEW "OPAX"

OPPOSED ACTION LINKAGE



New Concept in Opposed Action Damper Construction

ACCURATE! and as easy to fabricate as conventional dampers.



"OPAX" Linkage Set is Complete as Shown

"OPAX" Set attaches directly to blade — No Stands.

Accurately operates damper blades as narrow as 5"

Extremely simple to lay-out and install.

Neva-Bind construction assures smooth operation . . . Compensates for damper inaccuracies.

Write now for complete information and local distributor — or . . . send $1.00 for sample "OPAX" Linkage Set.

THE GREATEST NAME IN SHEET METAL SPECIALTIES

BLADE KIT

FLEXIBLE CONNECTOR

ADHESIVE

TAPE

QUADRANT

DURO-DYNE CORP., Route 110, Farmingdale, New York

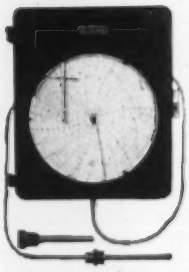
4½" DIAL THERMOMETERS

Made in 3 types to suit any requirements. Rigid stem, wall or flush mounted, 11 inches of scale reading. Interchangeable with standard industrial separable sockets. Stem can be placed at any angle and case can be rotated to any readable position.

PALMER

MERCURY ACTUATED

Temperature Indicating Instruments



RECORDING THERMOMETERS

Twelve inch die-cast aluminum case with black or white wrinkle or satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges —40 +950°F or Equivalent in °C.

INDUSTRIAL THERMOMETERS

Red-Reading Mercury —Extruded brass case — chrome finish. Ranges —40 + 950°F or Equivalent in °C.

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Thoroughly annealed for permanent accuracy. Complete line A.S.T.M. and fractional division types.

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BOILER-BURNER UNIT

This is the modern 3-PASS boiler with *complete* wet back that makes refractory problems a thing of the past . . . the Titusville Boiler that gives you faster steaming, better heat extraction, higher efficiencies all along the line! No welded tubes, lower stack temperature—everything for longer life and dependable service. *Check us!*

Write for latest Bulletin B-3333

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Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

Plants at Titusville, Pa. and Warren, Pa.

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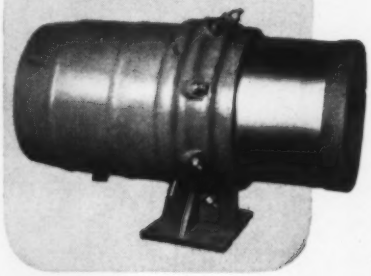
important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS



For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 107 Mermaid Lane, Phila. 18, Pa.

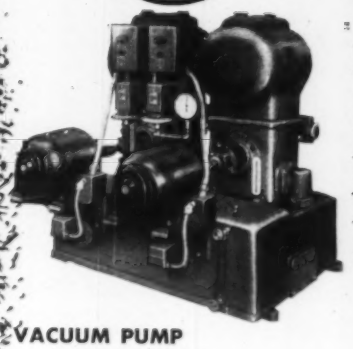
go YARWAY with confidence

Skidmore

. . . the PUMP that offers CUSTOM DESIGN . . . at a "standard price"

Built to match your exacting conditions . . . inexpensive to install . . . inexpensive to operate . . . inexpensive to maintain. There's a Skidmore Heating Pump for that unusual condition—for that below floor level return—for that low return system or low and high pressure requirements. Advance design and engineering principles built into every Skidmore pump will give you year-ahead dependability and trouble-free service on every job.

MAINTAINED SKIDMORE PUMPS EFFICIENCY



VACUUM PUMP

Capacities range from 5,000 to 100,000 sq. ft. E.D.R.

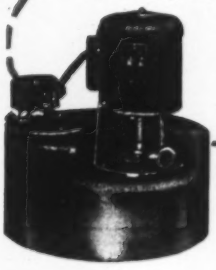
single unit

TYPE "UV" CONDENSATE

Capacities range from 2,000 to 40,000 sq. ft. E.D.R.

(Below) TYPE "CVS"

Capacities range from 500 to 10,000 sq. ft. E.D.R.



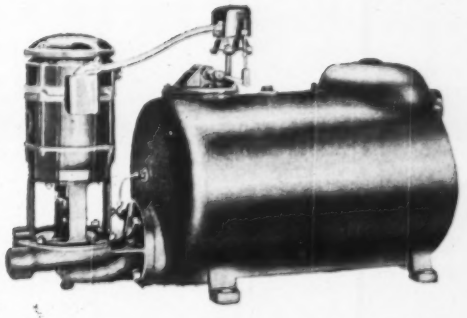
SKIDMORE PUMPS

WRITE FOR BULLETINS

Specify a Skidmore Pump on that next job . . . there's one for every installation.

(Right) TYPE "VC"

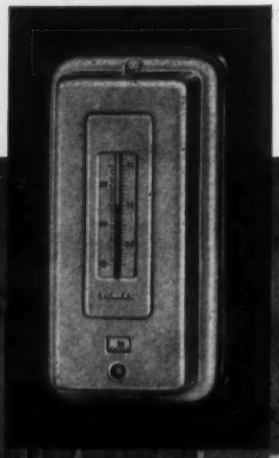
Capacities ranging from 1,000 to 65,000 sq. ft. E.D.R.



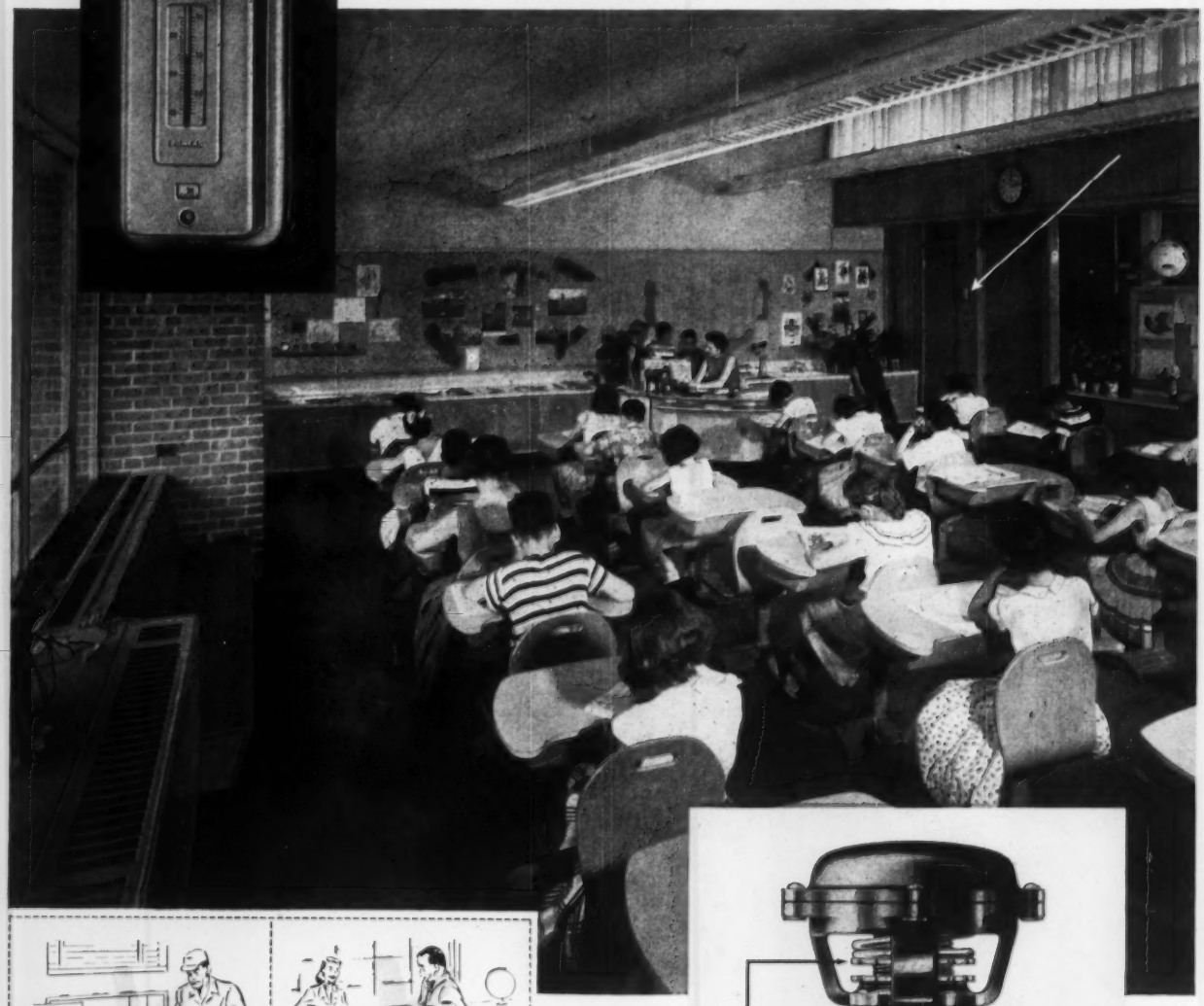
SKIDMORE CORPORATION

ST. JOSEPH, MICH.

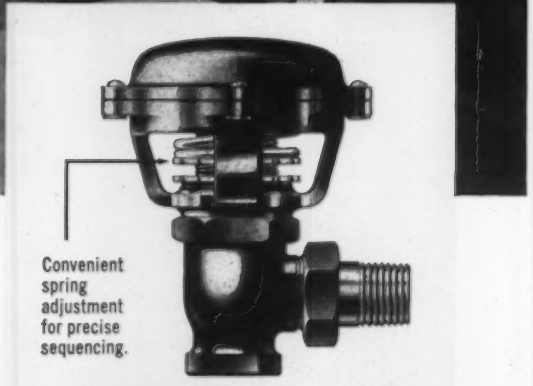
How schools benefit from



A truly gradual acting thermostat—controls unit ventilators and convectors. Day-Night type thermostat available with automatic changeover.



Banish packing Maintenance and Leakage with—



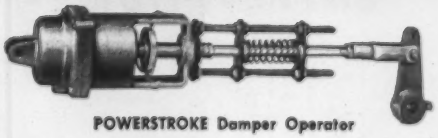
Convenient spring adjustment for precise sequencing.

Powers PACKLESS Control Valve

Powers PACKLESS Control Valves are standard for unit ventilators, convectors and unit air conditioners

They give more ACCURATE control—due to less valve stem friction. SIMPLE, few moving parts with minimum vulnerability to environmental hazards such as dirt, moisture, etc.

Both Controls are specifically designed for Unit Ventilators.



POWERSTROKE Damper Operator

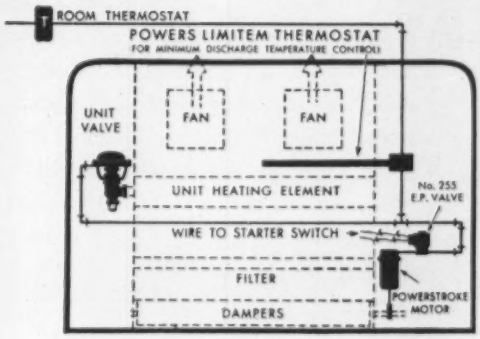
POWERSTROKE Damper Operator gives smooth gradual action of unit ventilator dampers. Accessible adjustment allows sequencing of dampers in accordance with A.S.H.A.E. unit ventilator control cycles.

QUALITY FEATURES provided by

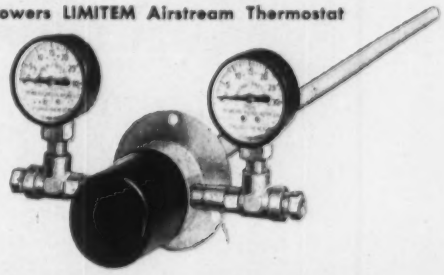
POWERS

MODERN pneumatic system of
UNIT VENTILATOR CONTROL

Teachers, Pupils and Taxpayers all benefit when you specify POWERS *temperature control*



Powers LIMITEM Airstream Thermostat



A precision instrument with calibrated dial and adjustable sensitivity to give precise throttling range.

Greater **SIMPLICITY** of Powers **Direct Control** Prevents OVER-heated classrooms and cold drafts and insures Lowest Cost Maintenance

Powers LIMITEM Airstream Thermostat with its efficient direct control gives precise regulation of unit ventilator discharge temperature without using complicated auxiliary devices.

LIMITEM performance and reliability have been time tested and proven in thousands of schools. Valve and damper operator which it controls are shown on opposite page.

Powers Responsibility for correct installation and dependable operation is accomplished by directly employed Powers mechanics with years of unit ventilator control experience.

There is no extra charge for Powers Quality and year after year dependability. When you specify a Powers modern pneumatic control system for unit ventilators your client gets the best. There is no better.

Use Powers 65 years of Experience and engineering know-how to help you select the most efficient type of control for schools or other buildings.

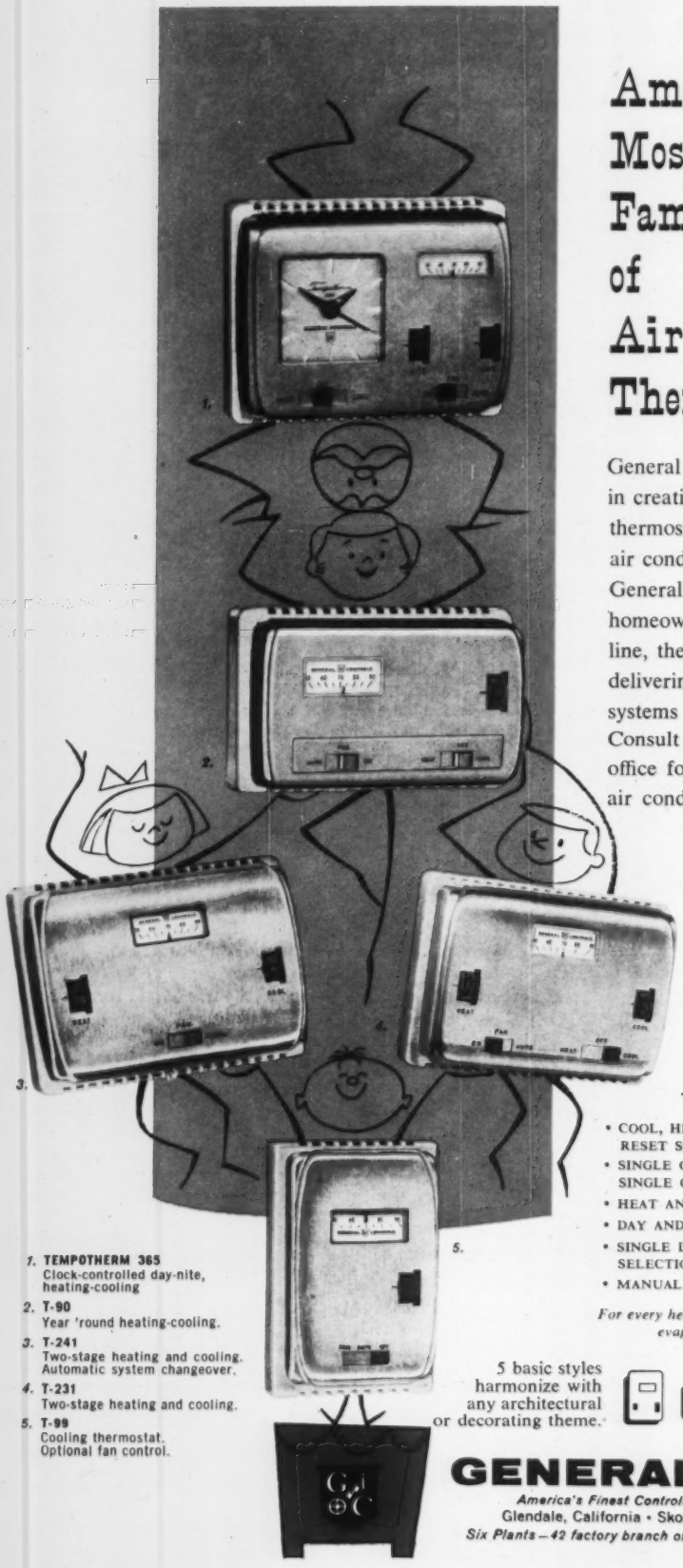
A nearby Powers factory and field trained engineer will gladly assist you. There's no obligation. Call our nearest office.

(c95)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A. and Canada*

65 Years of Automatic Temperature and Humidity Control



1. **TEMPOTHERM 365**
   Clock-controlled day-nite, heating-cooling
2. **T-90**
   Year 'round heating-cooling.
3. **T-241**
   Two-stage heating and cooling. Automatic system changeover.
4. **T-231**
   Two-stage heating and cooling.
5. **T-99**
   Cooling thermostat. Optional fan control.

America's Most Complete Family of Air Conditioning Thermostats!

General Controls continues to set the pace in creating the kind of *advanced design* thermostats that afford maximum selectivity in air conditioning thermostats. Not only do General Controls thermostats please the homeowner with their beauty and simplicity of line, they also signify *quality*—and prove it by delivering the top performance engineered into systems and related equipment.
Consult your nearby General Controls branch office for complete details on the many air conditioning thermostats available.

ALL WITH MODERN MERCURY SWITCH DEPENDABILITY...

118 FUNCTION VARIATIONS TO CONTROL ANY SYSTEM

- COOL, HEAT, FAN, AUTO, OFF, RESET SWITCHING FUNCTIONS
- SINGLE OR TWO-STAGE HEATING WITH SINGLE OR TWO-STAGE COOLING
- HEAT AND COLD ANTICIPATION
- DAY AND NIGHT CLOCK PROGRAMMING
- SINGLE DIAL OR TWO DIAL TEMPERATURE SELECTION
- MANUAL OR AUTOMATIC CHANGEOVER

For every heating and cooling requirement: gas, oil, coal or electric, evaporative, chilled water and heat pump systems.

5 basic styles harmonize with any architectural or decorating theme.

GENERAL CONTROLS

America's Finest Controls for Home, Industry, and the Military
Glendale, California • Skokie, Illinois • Guelph, Ontario, Canada
Six Plants—42 factory branch offices serving the United States and Canada

The Fantasy, Wildwood, N. J.: 1700 ft Beth-Co-Weld steel pipe.

The Carousel, Wildwood Crest, N. J.: 1625 ft Beth-Co-Weld pipe.

The Twenty-Fourth St., North Wildwood, N. J.: 1835 ft Beth-Co-Weld pipe.

For these motels, Pipe Jobber: Seashore Supply Co., Wildwood and Atlantic City. P & H Contractor: Harbor Plumbing and Heating, Wildwood.

Steel pipe is economical pipe

Jersey Shore motels save from the word "go" with Beth-Co-Weld steel pipe

Motels, hotels, schools, homes—all get a head start on economy when their plans specify Beth-Co-Weld steel pipe. Beth-Co-Weld installs fast and works easily—and gives years of low-maintenance service.

There's no pipe more dependable than steel—and it's still the lowest-cost pipe you can buy!

Drainage lines, ventilation, water and gas lines—Beth-Co-Weld is ideal for all of these. It's made from high-quality steel by the continuous-weld process, which means it's uniform pipe, sound and strong for easy handling. It's available, black and galvanized, in sizes from ½ in. through 4 in., and in uniform 21-ft lengths, and random lengths.

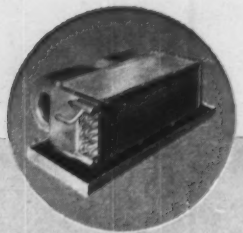
When you're ready to specify, consider the advantages of steel pipe. Then ask your jobber for Beth-Co-Weld.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem Steel products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



HIDEAWAY SEASONMAKER

McQUAY

Means Quality

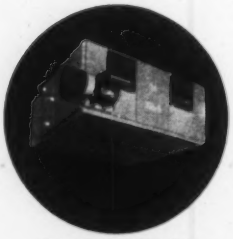
When you think of quality, you automatically think of McQUAY, because McQUAY MEANS QUALITY.

Only McQuay units are equipped with the famous and exclusive Ripple Fin coils which create the maximum air turbulence necessary for efficient heat transfer. Expanding the copper tube against the wide, full fin collars, which act as automatic spacers, provides rigid metal-to-metal contact and completely covers the copper coil to form a "tube within a tube".

The complete McQuay product line is constructed of the finest heavy gauge materials—combined with the NEW McQuay Galva-Seal process, bonderized and then finished with a special formula enamel baked on—offering you the finest corrosive resistant assembly available. And, the Dura-Frame "V" channel construction, another McQuay exclusive, provides the strength and rigidity necessary to quiet, trouble-free operation.

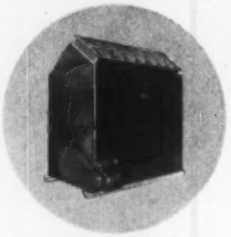
There is no substitute for quality, no substitute for the experience and the research and engineering for which McQuay is famous.

Compare McQuay in every way—from the appearance and beauty of the finished product to the heart of each unit, the coil itself—and you will readily see why McQUAY MEANS QUALITY—and quality means performance and long life. McQuay, Inc., 1601 Broadway Street N.E., Minneapolis 13, Minnesota.

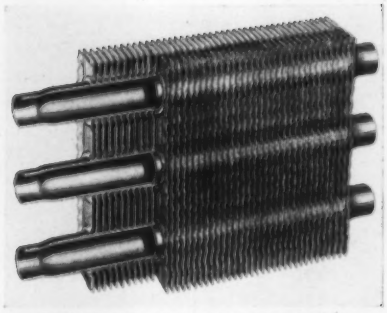


SEASONMASTER AIR CONDITIONER

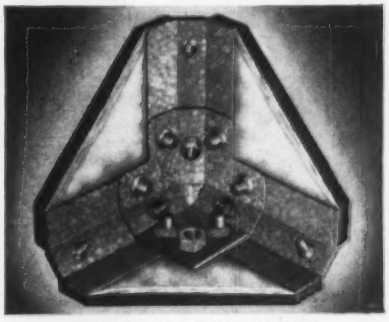
INDIVIDUAL ROOM SEASONMAKER



MULTI-ZONE AIR CONDITIONING UNIT



RIPPLE FIN COIL CONSTRUCTION



DURA-FRAME "V" CHANNEL CONSTRUCTION

McQuay Means Quality

SQUELCHING the concept that the air source heat pump is limited to applications in more southerly climates, a year 'round system of this type near Buffalo uses freezing air to heat a new engineering laboratory. *See page 89.*

What types of work might a consulting engineer and mechanical (heating, piping, and air conditioning) contractor be expected to perform in designing and installing piping for nuclear processes? *See page 107.*

Hidden causes of high dewpoints and depressed dry bulb temperatures can thwart the best of insulating jobs. How can you be sure these sweating problems won't occur? *See page 110.*

May Building Contracts Break All-Time Record

. . . highest ever for single month

CONSTRUCTION contracts in the U. S. in May totaled $3,402,575,000, the highest figure ever reported for any single month, according to F. W. Dodge Corp.

The May total was only a small fraction of 1 percent above the previous record set in May 1957, but it exceeded the third highest month (June 1957) by 5 percent.

Commenting on these new figures, Thomas S. Holden, Dodge vice chairman, said it was now evident that "construction is well past the bottom of the recession it was experiencing in late 1957 and early 1958."

According to Mr. Holden, "the effects of the recession on construction as a whole were at no point as severe as in other important sectors of business activity, although it is true that some types of construction suffered more than others. As in the earlier postwar recessions, construction has remained relatively steady, and has helped to cushion the downward push on the economy. Now that construction is turning upward, other industries should also be stimulated."

The May construction contract total for nonresidential building was reported by Dodge as $1,124,087,000, up a fraction of 1 percent from May 1957. Contracts for commercial and factory buildings were down sharply, and educational buildings were off slightly, but other nonresidential building types increased.

Contracts for residential buildings in May totaled $1,346,170,000, an increase of 4 percent over May 1957. The number of dwelling units covered by the May contracts was 104,048, the highest monthly total in two years and 2 percent above last May. The number of single family units was 1 percent ahead of May a year ago, and the number of units in apartment buildings was up 11 percent.

Heavy engineering contracts in May were $932,318,000, down 5 percent from last May.

Cumulative construction contract totals for the first five months of 1958, with percentage changes from the corresponding period of last year, are as follows: nonresidential building, $4,538,896,000, down 5 percent; residential building, $5,145,117,000, down 3 percent; heavy engineering, $3,299,511,000, down 8 percent; total construction, $12,983,524,000, down 5 percent.

While these cumulative figures show the current year lagging behind 1957, the spread between the two years has narrowed considerably during the past three months. ≠

ASRE Adopts Standards, Elects New Officers

. . . at annual meeting

THE FOLLOWING standards were adopted at the recent annual meeting of the American Society of Refrigerating Engineers in Minneapolis:

1) Revision to American Standard Safety Code for Mechanical Refrigeration, B 9.1-1953. The revision is based upon inquiries received and problems encountered with reference to the safety of all types of refrigeration systems since the last revision of this standard in 1953.

2) Revision to American Standard Refrigeration Terms and Definitions B 53; Group 10, Thermodynamics; Group 20, Properties and Materials; Group 30, System Components; Group 40, Systems and Processes.

The new president of ASRE is Cecil Boling, president, Dunham-Bush, Inc. Other officers are: D. D. Wile, vice president, Recold Corp., first vice president; Robert H. Tull, Westinghouse Electric Corp., second vice president; and F. Y. Carter, Detroit Controls Div., American Radiator & Standard Sanitary Corp., treasurer. ≠

Unusual "Package" Job Cools Miami Classrooms

. . . 500 ton system

THE USE of multiple packaged air conditioning units for commercial application is common practice, but the method with which such units are being utilized in a Florida project is believed to be unique, Trane Co. reports.

Requiring about 500 tons of cooling, the unusual application is also regarded as a first in the school field. In total, about 120 three and 5 ton fan cooling units and an equal number of 3 and 5 ton air cooled refrig-

eration units are currently being installed at the University of Miami.

According the Gene Cohen, University of Miami vice president, the air conditioning of classrooms and other educational facilities has been prompted, in part, by the need for improved temperature control during summer months. Increasing attendance at Miami's summer session with more and more of the school plant experiencing hot weather use expedited the air conditioning program.

According to J. J. O'Day, director of physical plants for the university, "The air conditioning units selected for this project are unique for this type application."

Criteria upon which the final decision was based were:

1) Need for individual temperature control for each classroom so that it would not be necessary to operate all the units when just a few classrooms are in use.

2) Large size of the classrooms to be conditioned, ruling out ordinary room type units.

3) Noise factor where any disturbance would conflict with classroom activity.

The units feature a remotely located waterless compressor-condenser package with a compact blower and heating-cooling coil unit installed in the conditioned area.

In some cases, ductwork will be added to distribute the air to the various areas. In others, the units will discharge the air directly.

The mechanical (heating, piping, and air conditioning) contractor for this job is McDonald Air Conditioning, Inc. ∓

Ads to Inform Prospects Of Air Conditioning Costs

. . . reach commercial, industrial market

A RECENT STUDY of the role of air conditioning in commercial and industrial concerns, conducted by E. I. du Pont de Nemours and Co., pointed out that the majority of these concerns felt that they "could not afford air conditioning." But at the same time this same majority had no real idea of what it actually would cost to air condition their place of business.

In an effort to throw a brighter light on the subject of air conditioning costs for commercial and industrial installations, Worthington Corp. has scheduled a series of special advertisements in New York, Philadelphia, Atlanta, and New Orleans newspapers.

Typical air conditioning costs, including product and installation, have been figured on a square foot basis. For a prescribed area a range of costs will be shown to cover both simple and complicated installations.

The dominant feature of these ads is a cost chart which will give the commercial or industrial prospect an immediate idea of what it will cost to air condition his store, office, or plant.

By giving the prospective buyer this information Worthington feels that three important hurdles will be overcome:

1) The buyer's feeling that air conditioning costs are sky-high will be tempered.

2) Presenting a range of costs that can be applied to a building simply by measuring the area will present an immediate approximate cost picture. Then and there, the prospect will know whether he can afford air conditioning or not.

3) Costly and wasteful specification writing will be reduced, as the prospect has already been conditioned to the cost of air conditioning. ∓

36th OHI Convention Largest in History

. . . 1300 attend

BY ALL COUNTS, the 36th annual convention of the Oil Heat Institute of America, held in New York, June 9-12, was the largest on record. The 1958 registration of 1300 topped last year's total by more than 500, OHI reports. Delegates came from nearly every state.

"Enter the Profit$phere in '58" was the theme of the concurrent 22nd National Oil Heat and Air Conditioning Exposition, which occupied the 65,000 sq ft of first floor exhibition space at the New York Coliseum.

J. Verne Resek, Milwaukee, president of OHI, sounded a feeling of confidence and optimism when he said, "I have enough confidence in this country to start a new large enterprise, mainly dependent on oil burning equipment. I know that there are others in this industry who feel the same." ∓

Air Conditioning Is Tool In Electronics Growth

. . . to remove tremendous heat

AIR CONDITIONING has become an important element in the growing electronic automation of business, industry, and defense, Carrier Corp. says.

Modern computers, producing tremendous heat from their electrical systems while making intricate calculations, require extensive cooling to insure efficient operation.

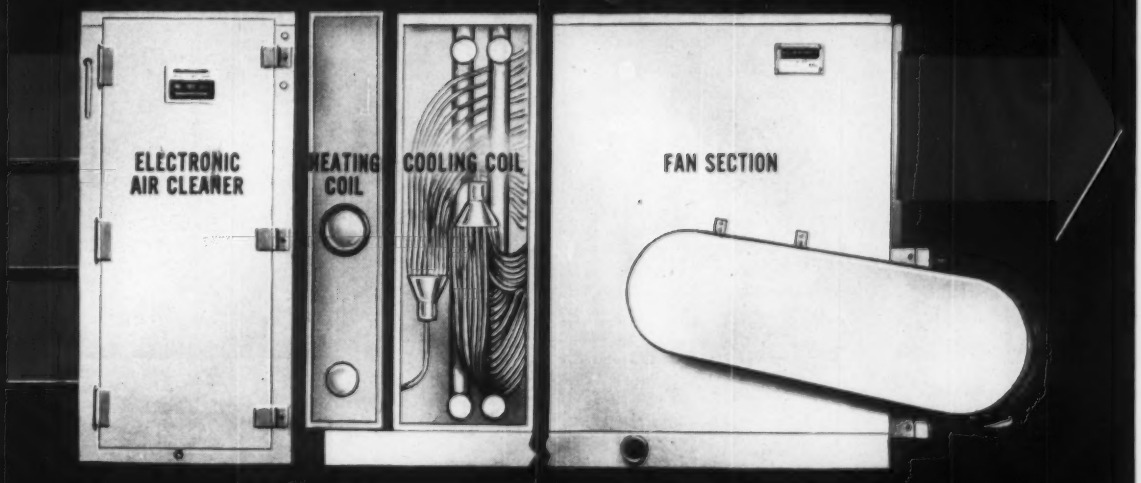
Electronic equipment users urge air conditioning because vacuum tube life is doubled, operators are more comfortable, and the equipment is less likely to be in error if the temperature and humidity are kept within prescribed limits, the companies say. ∓

"Quote"

"We don't know for sure how much air pollution is costing us, but our conservative estimate is . . . about $4 billion annually." — ***Haldon A. Leedy, director, Armour Research Foundation of Illinois Institute of Technology, at a recent joint luncheon meeting of the American Power Conference and the Western Society of Engineers in Chicago.***

when you

condition air and distribute air...



make sure you specify Westinghouse– the complete line*

Standard Air Conditioning Units
Multi-Zone Units
Sprayed Coil Units
Low Headroom Units
Heating & Ventilating Units

* *All* components Westinghouse-manufactured—single equipment warranty—a Westinghouse exclusive.

and only from Westinghouse...

Electronic Air Cleaner Sections for "In-Line" Assembly only 25½" in direction of air flow—with manual or automatic washing.

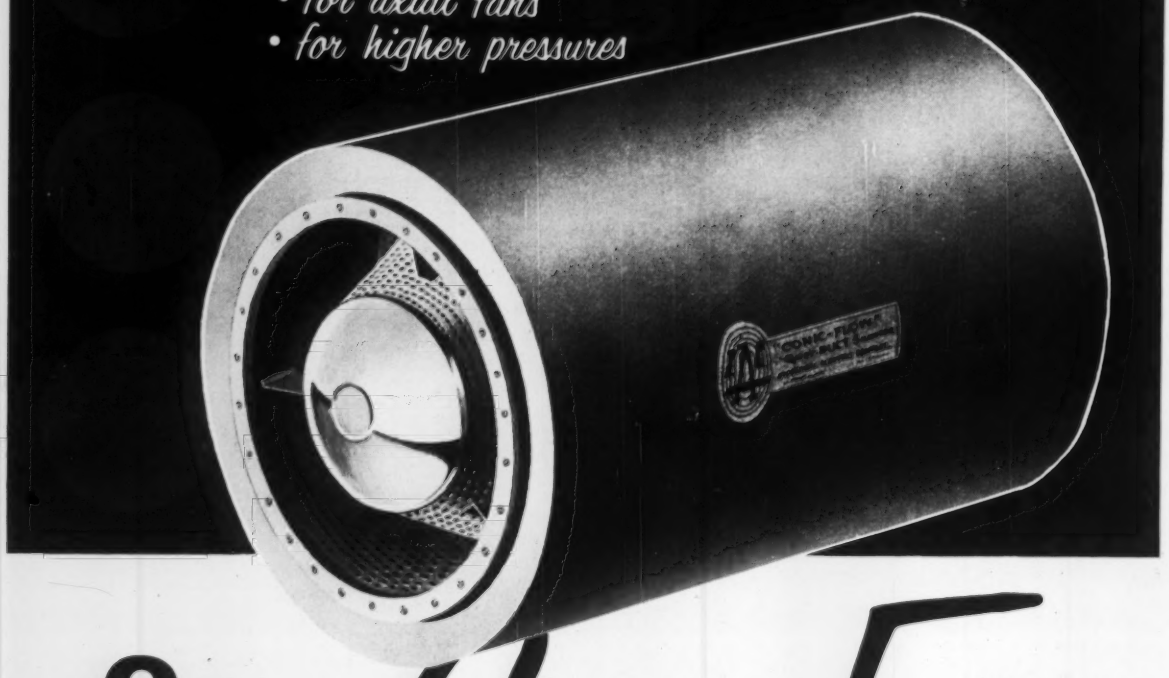
More Information? Call your Sturtevant Division sales engineer, or write Westinghouse Electric Corporation, Department H-2, Hyde Park, Boston 36, Massachusetts.

J-80655

YOU CAN BE SURE...IF IT'S Westinghouse

Another First

- *for axial fans*
- *for higher pressures*



Quiet-DUCT *Conic-Flow*

Reg. U.S. Pat. Off

U.S. Pat. Appl. For

silencer

4 feet does the work of 40!*

* Only 4 ft. long, the new Conic-Flow Silencer does the work of 40 feet of lined duct!

ROUND . . . for easier installation!

ROUND . . . and **SIGHTPROOF** for maximum attenuation!

ROUND . . . for use on pressures up to 100" watergauge!

ALL Quiet-DUCT SILENCERS ARE LABORATORY TESTED AND CERTIFIED FOR AIRFLOW-PRESSURE DROP AND ACOUSTIC PEFORMANCE!

Air Conditioning Department
INDUSTRIAL ACOUSTICS COMPANY, INC.
341 Jackson Avenue, New York 54, N.Y.
CYpress 2-0180
"Specialists in Noise and Pulsation Control"

Air Conditioning Department
Industrial Acoustics Co., Inc.
341 Jackson Avenue
New York 54, N. Y.

☐ Send details on "Conic-Flow" Silencers and new Quiet-DUCT catalog.
☐ Have representative call.

Name _____ Title _____
Company _____
Address _____
City _____ Zone ____ State ____

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Was There Evidence of Improvement After Each Steam Line Revision?

THE ARTICLE, *Revise Steam Lines, Improve Metering to Keep Abreast of Heating Needs*, by C. M. Holden and Norman Goodwin, Jr. (May), presents an unusual approach to the heating of large educational institutions. Most such institutions are served by their own boiler plants. It is interesting to note that Harvard departs from this practice and purchases its steam. The succeeding steps in the development occasioned by Harvard's increasing physical plant are outlined chronologically and record the complete cooperation of two engineering staffs in solving current problems.

I am at times skeptical of the operation of facilities after a development program has been completed. It would indeed be interesting to have the authors discuss the improvement in performance as shown by the total steam evaporated by the boilers and the sum of the distribution line meter readings after each of the successive steps in the development. The authors have shown clearly the necessity of compiling and interpreting operating data continuously in order that alert management can institute corrective measures at significant periods.

The installation of the express steam main to overcome extreme pressure drop was an unusual procedure which, I suppose, involved a large expenditure. Undoubtedly, the expedient of increasing the distribution line pressure was considered and discarded in lieu of the express installation.

Interestingly, the comprehensive metering of steam used in an educational institution was outlined and described in an article, *Alert Management, Meters, and Proper Control Cut Building Heating Costs*, by myself, way back in the July 1934 issue.

LESTER S. RIES
Formerly Superintendent
Buildings and Grounds
Oberlin College
Oberlin, Ohio

Does Modernized Hotel System Violate Fire Underwriters' Recommendation?

I READ with much interest the article 18 *Zone Cooling Modernizes a 9 Story Hotel* (August 1957).

The economy of this system is very impressive.

However, I was surprised that you would publish an article regarding an installation which, according to my interpretation, is a violation of the recommended practice as set forth by the National Board of Fire Underwriters. I refer to the design feature pertaining to using the hall as a return air plenum. I am surprised, also, that the State of Illinois would permit, by its building code, the installation of such a system, since the hazard of spreading a fire would certainly be much greater.

If I am incorrect in my interpretation of the NBFU recommendation, I would appreciate your clarification in this connection.

MICHAEL W. WASELL
Professional Engineer
Wasell Engineering Service
Winston-Salem, N. C.

THE HOTEL'S REPLY—At the time the air conditioning installation was made at the Hotel Leland it was not in violation of our city ordinance. In fact, it was inspected and approved by the city building inspectors. There have been several similar installations made here in Springfield since the one at the Leland, I have been told.

While our air conditioning system was being installed we were also putting in an extensive communications system, including thermostatic fire detection and disaster alert which makes it possible for the hotel management to be in direct contact with all guests simultaneously and at a moment's notice. We feel, therefore, that we have good fire protection.

JAMES P. BOLINGER
President and General Manager
Hotel Leland
Springfield, Ill.

"Transverse" Ventilation System Very Similar to Holland Tunnel's

IN READING, *"Transverse Tunnel Ventilation Assures Uniform Air Distribution,"* by H. G. Cruthers (July), describing the ventilation system in the new Baltimore Vehicular Tunnel, I was impressed by the close similarity of this ventilating system with that in the original Holland Tunnel under the Hudson River at New York.

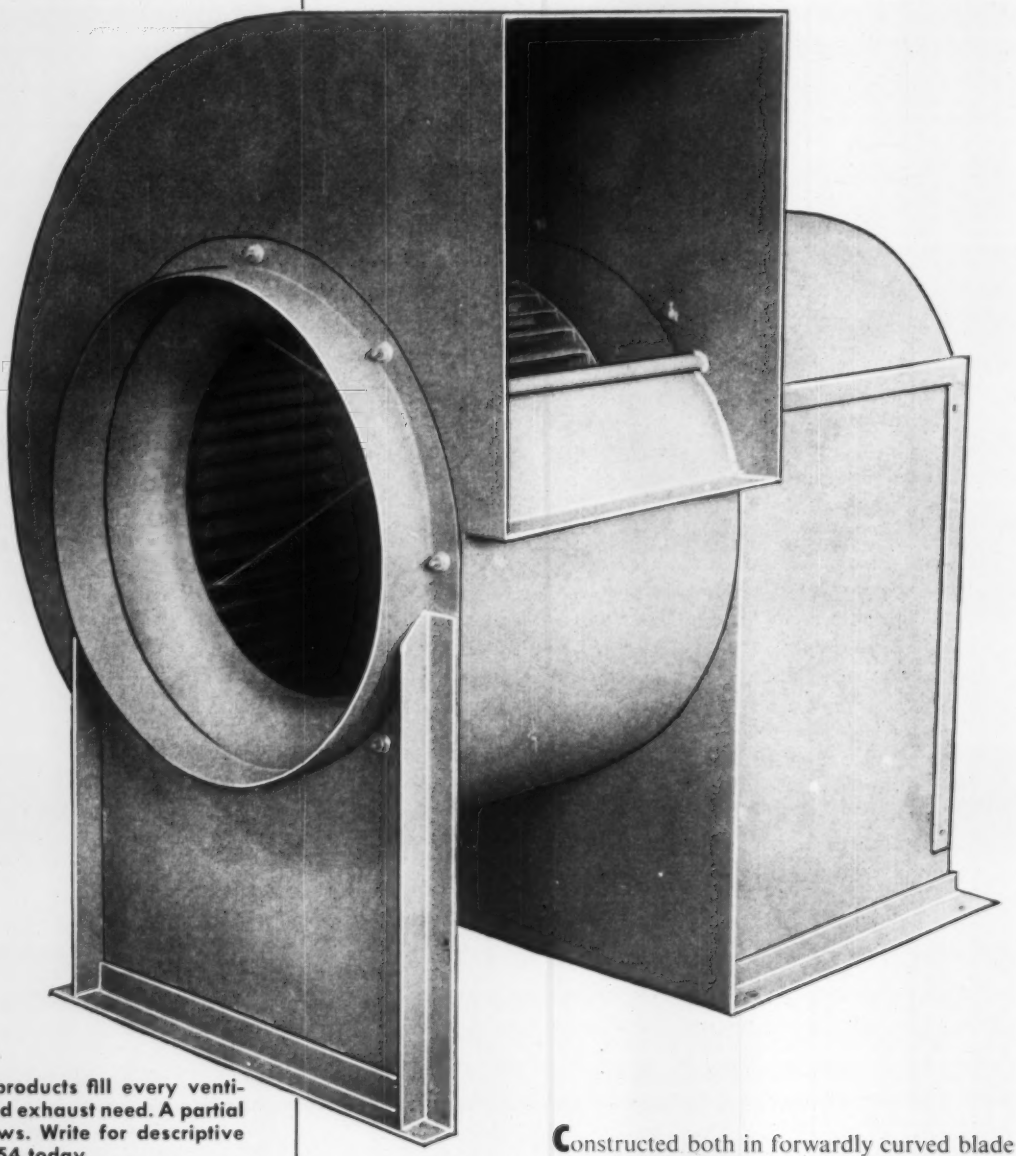
The man who designed and built most of that tunnel

(Continued on page 80)

If you need to move air...

BARRY

Belted Ventilating Sets do it BEST!



BARRY products fill every ventilation and exhaust need. A partial list follows. Write for descriptive bulletin 54 today.

FC ventilating fans
Induced draft fans
Steel plate fans
Fan wheels and scrolls
BBC ventilation fans
Forced draft fans
Fume exhaust fans
Utility exhausters
Belted ventilating sets
Material handling fans
Medium pressure blowers
Special applications

Constructed both in forwardly curved blade and non-overloading design, and available in 12 sizes to 22,000 cfm, Barry designed units perform your specific job easily and economically . . . Because they are convertible in discharge for ready adaptability, Barry belted ventilating sets get your installations into efficient operation in record time.

BARRY BLOWER CO.
3100 CALIFORNIA ST. N. E. • MINNEAPOLIS 18, MINN.

B.F.Goodrich

B. F. Goodrich saves Sheraton a cool $9,517.26

Philadelphia's new Sheraton boasts 8,100 feet of B. F. Goodrich Cell-Tite Tubing on water lines of 1,000 room air conditioners, and for good reason!

Saves labor costs: "With B. F. Goodrich Cell-Tite Tubing," says Mr. Earle Baltz, executive of Achenbach & Butler, Inc. insulation specialists, "we cut the time needed to put insulation on two lengths of pipe from a normal three hours to only 20 minutes. This individual saving of two hours and forty minutes became a saving of 2,666 man-hours on the whole job. Labor on this cost $3.57 per hour—multiplied by the total time, making a saving of $9,517.26!"

Why they selected B. F. Goodrich Cell-Tite: "It effectively prevents condensation on pipes carrying cold water through warm areas, holds heat of hot water in pipes. The material suffers no effects from constant exposure to maximum heat rating . . . continually holds up under heats approaching its rated 220° resistance, has a K factor of .27 giving maximum insulation without undue thickness, is consistent and uniform in quality and assures even all-around insulation by being of 'closed-cell' construction."

Easy to install: "This tubing cuts labor costs by easy-threading on pipe, fits around bends, gives a much neater appearance. To strip the ends, we held the tubing back clear of the connection, held it in place with wire. After the connection was made, the wire was cut and the insulation moved over the exposed section. Even after being wired in a compressed position for two months, the tubing showed no permanent set!"

Get free booklet: For complete information and free booklet write The B. F. Goodrich Company, 481 Derby Place, Shelton, Connecticut.

B.F.Goodrich
insulation tubing

(Continued from page 77)

and its "transverse" ventilating system was Clifford M. Holland. He was the original (1919-1924) chief engineer of the New York State and the New Jersey Interstate Bridge and Tunnel Commissions. Mr. Holland died on October 27, 1924, and was succeeded by Milton H. Freeman. He, too, died a year later and he was succeeded by Ole Singstad, one of the principals of the consulting engineering firm with which Mr. Cruthers is associated.

Many underwater vehicular tunnels have been built since and, so far as I know, all have used the Holland Tunnel "transverse" ventilating system with complete success. There is probably no man alive today who has had more experience with tunnels of this type than Mr. Singstad, and I am sure that the Baltimore tunnel will continue to justify the "transverse" system of tunnel ventilation adopted by Mr. Holland for his tunnel back in the 1920's.

A. C. Willard
President and Professor Emeritus
Heating and Ventilating
University of Illinois
Urbana, Ill.

Article on Prison Heating, Ventilating Covers Systems' Design Ingenuity

John H. Ross's article, *Prison's Heating, Ventilating Systems Meet Maximum Security Needs* (June), covers very well the ingenuity required in designing facilities which provide for the comfort of prison inmates.

Placing the boiler room outside the prison enclosing walls is indeed an interesting departure from customary practice. Presumably the boiler room attendants will not be drawn from the inmates as is usual in many such institutions.

Ventilation of individual cells by means of vertical ducts rising from a small trench below the ground floor seems to make intercommunication between cells difficult indeed, although presumably some sort of a "Morse Code" rapping would still be possible.

Radiant heating in the floor and ceiling of the second floor develops a certain lag in response to change in heat requirements. Glass block fenestration develops high radiation surfaces when exposed to sunshine. The result of this combination might result in a rather uncomfortable condition at times.

Lester S. Ries
Formerly Superintendent
Buildings and Grounds
Oberlin College
Oberlin, Ohio

It's Hardly Possible to Determine Real Cause of Oily Soot Problem

The April Question of the Month, *What Causes Oily Soot Problem in High Velocity Air Conditioning?*, is difficult to answer. In a problem of this kind it is hardly ever possible to get enough information from which the real cause of oily soot entrainment can be determined. Someone with a great deal of experience in air filtration problems would have to check the job at the site, and even he may not be able to determine the cause.

In my opinion, the most likely cause of soot entrainment would be that there is a past history of inadequate filter maintenance, that the velocity distribution across the filter is uneven, and that the velocity distribution probably changes with damper setting.

If this were the case, then the soot and dust that has passed through the filter, especially in high velocity areas, could in time have accumulated in certain areas of the system to a point where it would be ready to be dislodged. At this point, fluctuating velocities due to changes in damper positions could jar the dust loose in the form of large agglomerates.

Corrections to insure even air distribution across the filter face might possibly be a permanent correction. If not, then cleaning of the system behind the filter would be.

Arthur Nutting
Vice President and Chief Engineer
American Air Filter Co., Inc.
Louisville, Ky.

Let's Rid Ourselves of Terminology Having Unwieldy, Unnecessary Words

I have noticed the comment on your "Open for Discussion" pages (April), *See HTHW Terminology Redundant; Also, Why Call Equipment Boilers?* I very heartily agree with Erik B. J. Roos that the term *HTHW*, or *high temperature hot water*, is redundant. I suggest that the word *hot* be left out since, if you have high temperature water, it obviously would be hot. I feel that just *HTW*, or *high temperature water*, is entirely adequate to portray the meaning.

In some articles describing the installations of systems using this heating medium I find some authors using the term *high pressure hot water*. This is just as unnecessary as *HTHW*, as I see it. If it is high temperature water then it is understood that it is under pressure. If not, it would not be water at all, but steam instead.

I also agree with Mr. Roos that the terminology *hot water boilers* should not be used, and concur with him that they should be called *hot water generators*. I even prefer the use of the term *steam generators* rather than *steam boilers* for those units producing steam. Perhaps some of the unwieldy terminology in connection with high temperature water is due to the fact that the medium is relatively new in this country and its name has been a carryover by steam engineers.

Let's get rid of the unwieldly and unnecessary words in our terminology used in connection with high temperature water engineering.

Sheldon R. Higgins
Mechanical Engineer
Long Beach, Calif.

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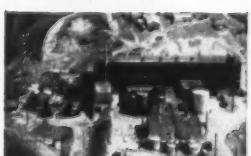

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Question of the Month

What's Best Way to Set Up Technical Reference Library?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"Our consulting engineering office is in need of an organized system for filing technical literature. We would like to know how to set up a system which would facilitate quick reference to all types of technical information."—B.A.L.

Time Tested Technical Filing System Serves Busy, "Lazy" Engineer

My system, which has more or less evolved by circumstances, may not be ideal, but it has stood the test of time. Its advantages appear to be: (1) it requires very little work; (2) it can tolerate some neglect; (3) its indexing is not confined to the contents of one office, since it embraces public libraries, neighbors bookshelves, etc.

The first principle in the use of the system is full use of the waste paper basket. Men are naturally "lower birds," and most literature received is of no immediate or prospective use. So most of what is received must be consigned resolutely and immediately to the waste paper basket, without its wasting valuable space and time.

Literature of interest must be placed in one fixed pile in one fixed position until time is available to give it attention. When this time is available all items are looked at. In my case, time is never available to read all literature cover to cover. However, browsing through at about 30 pages per minute will give a fair idea of what is of immediate and possible future interest. After examination, each item of literature is initialled to show that it has received attention.

During this browsing a pencil and a loose leaf ring bound book with alphabetically indexed cardboard divisions is kept close by. When an article of possible interest is noticed it is entered in this book, giving the name and date of the magazine and its page number. The title entered is not necessarily that of the original author, it may contain a catchword or idea to give the source of interest. Very interesting or authoritative reference may be emphasized by underlining or other means. At the same time, the page numbers are scribbled on the front of the magazine to indicate it must not be thrown out or destroyed without reference to those pages. If the publication contains nothing of reference value a large "O" is placed on the front cover.

In the looseleaf book the references are entered according to subject and the subject pages are arranged alphabetically. Some references may appear on several pages because they refer to several subjects. The book is a personal item and can be arranged to suit the individual. It can contain references from books, other libraries, letters, etc., if desired.

The literature which has been read is placed on a shelf, in a bookcase, or even in a heap in one fixed place where it is known it can be found. Manufacturers' data is placed on shelves according to the general type of product.

As the opportunity occurs, maybe once a year, the publications are gathered together and the front pages examined. If any shows many "O's" on its front covers and very few references of interest, the subscription is stopped and a more worthy magazine subscribed to.

If a magazine usually contains a few useful references, the past year's numbers are thrown out after removing the pages of interest. These pages are per-

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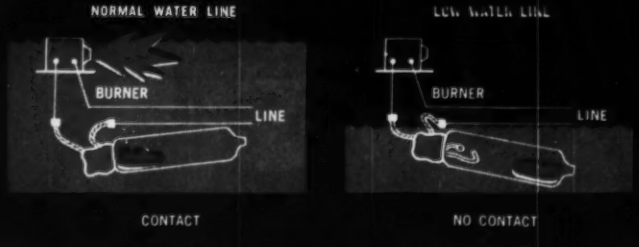

Single throw mercury switch is designed to break the electrical circuit to the burner. The entire switch mechanism is simple, foolproof, and has no mechanical parts to wear, stick, or fuse together, unlike other designs. Excellent for gas-fired installations — see below.

It pays to play it safe . . . whenever you install low pressure steam boilers

You're completely protected when you specify Watts Low Water Cut-Offs for low pressure steam heating boilers. The Watts advanced-design features described above make them the most efficient, most dependable cut-offs available today. Their excellence is proved by their wide acceptance.

Watts offers a complete line of boiler water level controls for heating and process steam boilers. For complete information, including specifications and installation diagrams, send for Bulletin F-60.

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The design of the standard mercury switch in all Watts Low Water Cut-Offs makes them **ideally suited** for millivolt service **on gas-fired heating installations.** Actual tests in use prove voltage loss is less than 1½ millivolts on a 700-millivolt circuit.

This means you need stock only one control for both standard and millivolt service.

Watts Regulator Company, Lawrence, Massachusetts

forated and stapled in folders marked with the subject. These folders are kept on shelves marked according to subject. For example, the shelf marked refrigeration contains folders marked "evaporators," "compressors," "condensers," etc.

Some magazines provide a wealth of interesting references. These are carefully taken apart, the reference material gathered, the annual index inserted, and the result delivered to a bookbinder for neatly binding in stiff covers. These bound volumes are stored in a bookcase. In the case of Heating, Piping & Air Conditioning, bound volumes date back to 1947 and my loose-leaf book, always kept within reach, contains reference to every item of reference interest in those volumes.

The above system has stood the test of time and abuse by a usually very busy and other times very lazy man.

R. Ahern
H. Platt & Associates
Consulting Engineers
Brisbane, Australia

Depends More on Individual Needs Than on Any Standard Technique

The answer to B.A.L.'s question will depend more on the individual office than on any standard technique.

First, the type of work being done by the office must be considered. Some pertinent factors in this area are:

1) Is their work all design work?
2) Is estimating or pricing involved?
3) Is any of their work of a research nature?
4) Is their work confined to a single narrow field, or do they cover a broad scope of engineering activities?

Second, how extensive do they want their library to be?

1) Will there be only engineering handbooks and some specialized books on their specific fields?
2) Will current technical journals and trade magazines be a part of the library?
3) Will records of previous jobs handled be included?
4) Will pamphlets and booklets from government, university, and other authorities be included?
5) Will current technical journals and trade magazines be kept? For only a short period of time, for extended periods, or permanently? Will a set of files be organized and pertinent material clipped and filed?

Third, what extent of cross-indexing will be required to meet their needs? For example, what kind of manufacturers' data will be required? Will product data only be required, or will price information also be included?

Fourth, how about the mechanics of handling the library? Who will be responsible for selection of the material to be included? Who will be responsible for the physical work of maintaining the library? Who will be responsible for cross-indexing and the other clerical detail required?

Finally, the size of the organization will to a great extent determine if a general library is economically and physically feasible. The question of an engineering library is one to which there is no easy, simple, or standardized solution.

D. C. McCoy
Consulting Engineer
Dayton, Ohio

Write to Special Libraries Association For Free Library Consulting Service

A free nationwide consulting service has been made available to businesses, industry, governmental agencies, and associations interested in developing libraries or information centers.

More than 5000 librarians and subject specialists, members of the international Special Libraries Association representing the U. S., Canada, and 25 countries overseas, now offer expert advice on need, cost, equipment, and staff problems.

Those interested may write to the Special Libraries Association, 31 E. 10th St., New York 3, New York.

Miss Florence H. Armstrong
Librarian
Ross Roy, Inc.
Detroit, Mich.

READER ASKS —

"How Can Leak Be Detected Under Concrete Floor Slab?"

"We are having trouble finding a leak in a radiant heating system which is installed under a concrete floor slab. The system was put in approximately 10 years ago. So far, in trying to locate the leak we have used a sonic detector with earphones, and have also drilled holes in the slab in the suspected area hoping that the presence of excessive moisture in the ground might lead us to it. Both of these efforts have been to no avail.

"Any suggestions from readers on how this leak might be located will be appreciated."—S.L.L.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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Mail the coupon now for complete description, including capacity and dimensional tables of sizes available for fast delivery. The Patterson-Kelley Co., Inc., 2108 Warren St., East Stroudsburg, Penna.

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FIBROCEL® PIPE INSULATION

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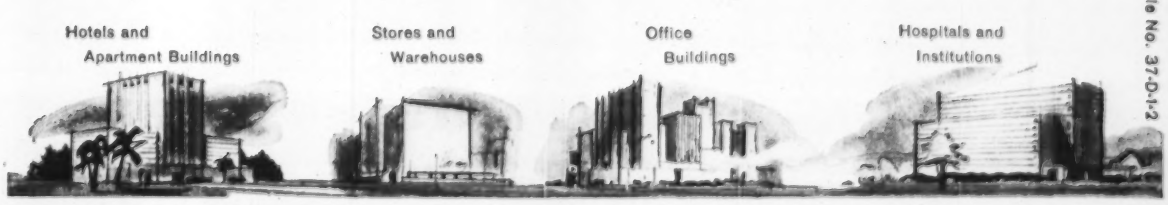

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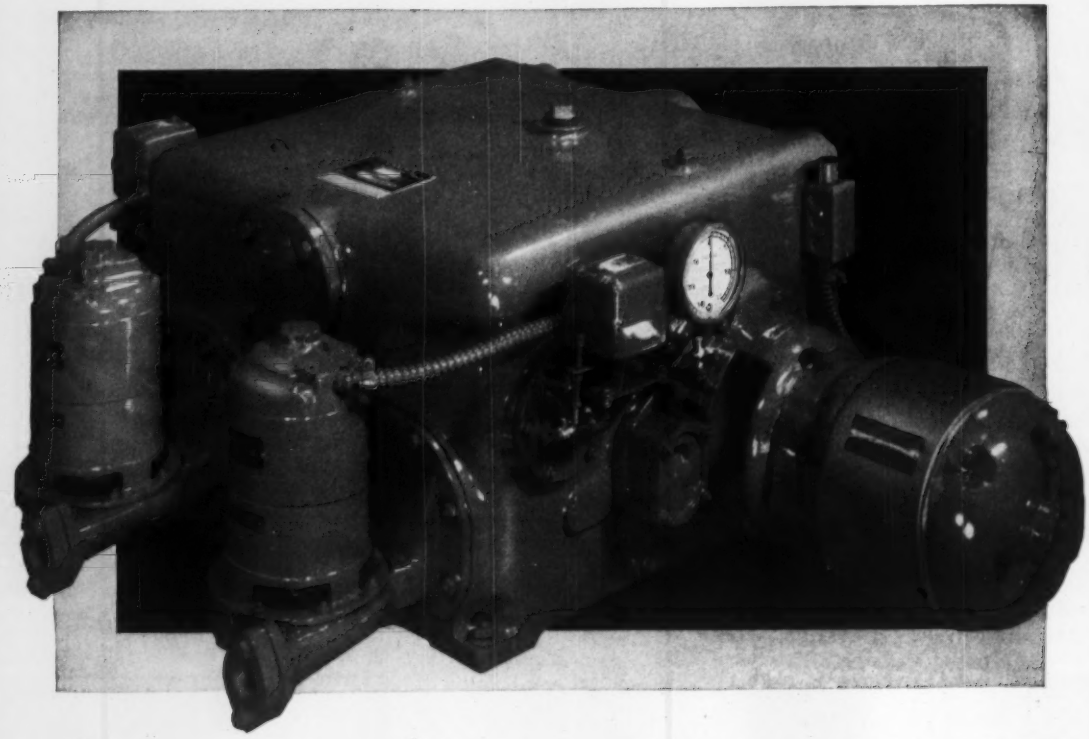

It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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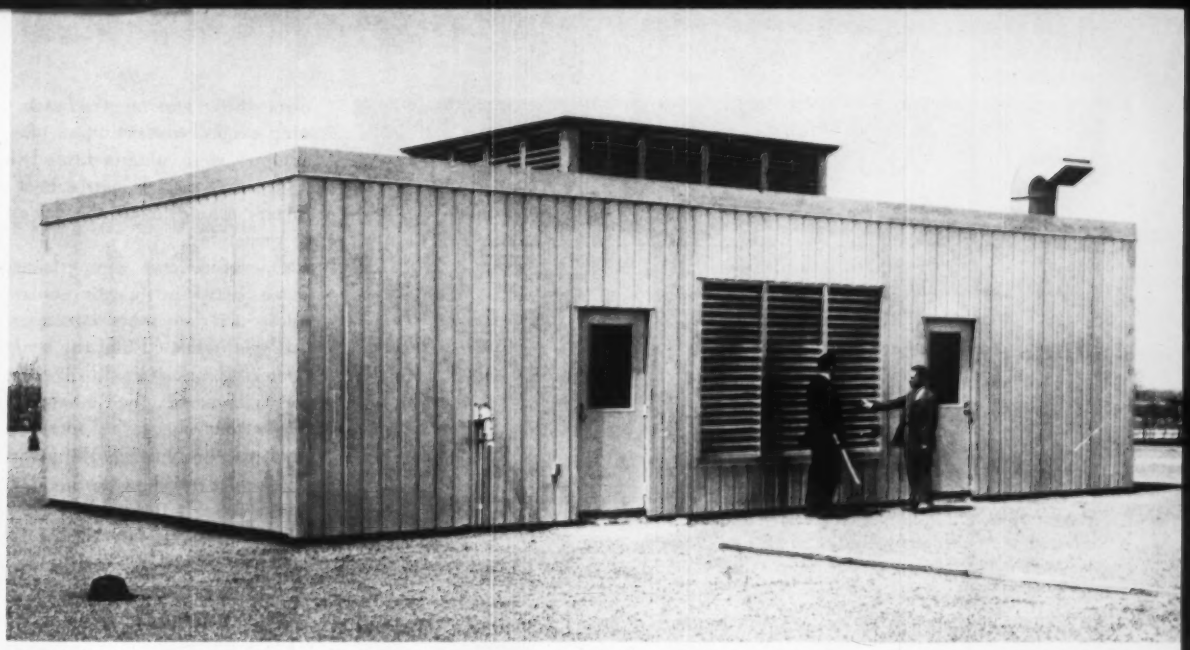


PENTHOUSE on roof of engineering laboratory contains fans for air distribution system. Fans have 65,000 cfm total capacity. Louver on top of penthouse is for admittance of 100 percent outside air when required. Louver being examined is exhaust air discharge

Freezing Air Heats Northern Lab

BY JOSEPH R. CAMPBELL
and
SHERIDAN A. YONDT
Professional Engineers
The Office of J. Fruchtbaum
Consulting Engineers

Air source heat pump installation near Buffalo comprises two systems, each serving separate building area. In addition to summer cooling, design permits single-stage or two-stage heating cycles to meet winter's extreme cold without supplementary heating.

THE NEW engineering laboratory for Sylvania Electronic Systems, a division of Sylvania Electric Products, Inc., located in Amherst, N. Y., on the outskirts of Buffalo, utilizes an air source heat pump for winter heating and summer cooling without the aid of supplementary electric resistance heating during extreme cold.

This installation is one of the most northerly locations for this type of system. Heat pumps of the water source type have been installed farther north, but these rely on a relatively constant temperature water source from wells or underground streams.

It is essentially a refrigeration system that either delivers heat to or removes heat from the outside air. This is accomplished by standard refrigeration compressors, condensers, and evaporators.

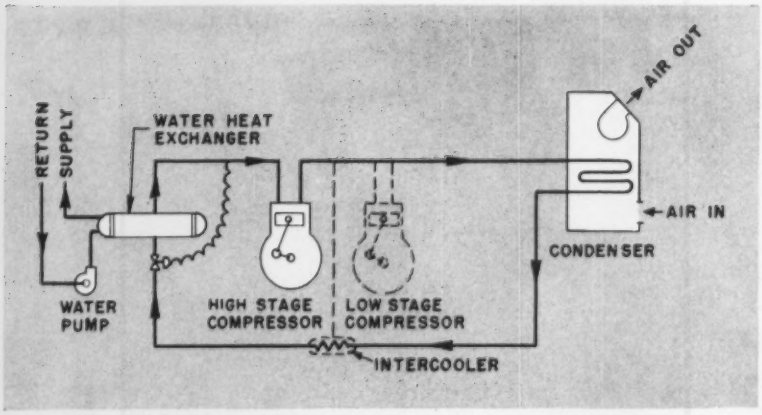
The air source heat pump system was selected over more conventional systems for several reasons:

1) The laboratory was to be located in a suburban community which is residential in nature. Sylvania desired a clean operation with no smoke nor fumes that might result in community complaints. The heat pump answered this problem.

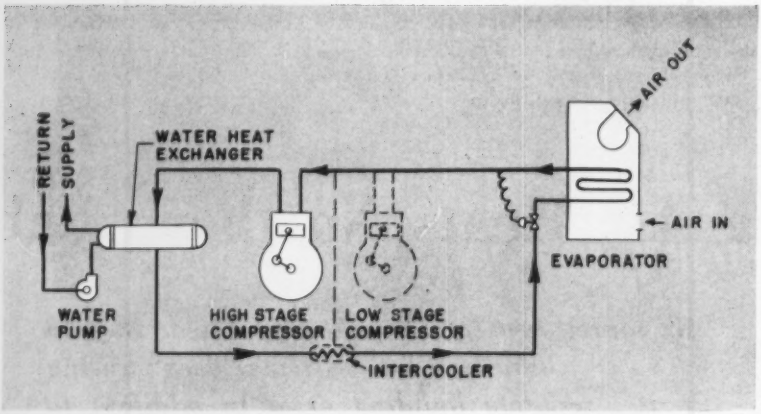
2) Secondly, it was felt that the heat pump would be economical in operation. Normally, the critical period for an air source heat pump in a northerly location is during the heating season when outside air temperatures are low. Because of a relatively high electric load which supplies heat in the form of light and power to the structure, the heat balance within the building was conducive to a heat pump installation. And, because of this high electrical load in the building, a favorable power rate is realized.

3) The heat pump, operating only on electric power, also tends to minimize seasonal fluctuations in power demand, reducing demand penalty. These factors, combined with a fairly low power cost for the area, indicated that operating costs for the system should be less than equivalent costs for a conventional system.

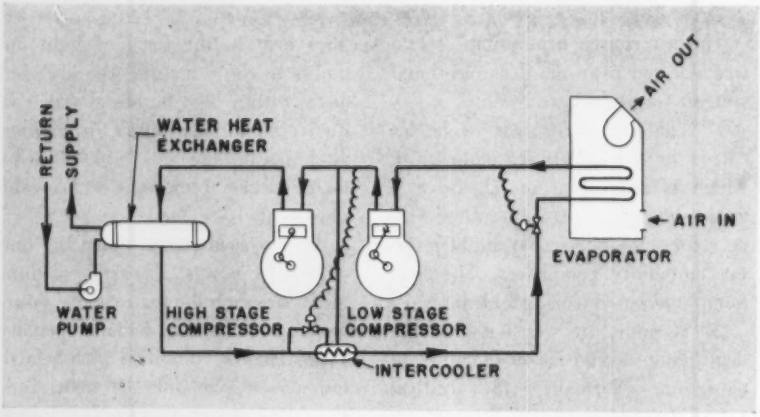
4) Another factor in the selection of the heat pump was the cost of



1 DURING COOLING CYCLE refrigerant is fed to heat exchanger where it picks up heat from circulating water, evaporating in process. This gas is then compressed, conveyed to condenser on utility wing roof. After being condensed, it is fed back to heat exchanger, completing cycle. Single-stage compression is used



2 SINGLE-STAGE HEATING, used when outside air temperature is above 20 F, uses only high stage (125 hp) compressor. Refrigerant is fed to evaporator (on cooling cycle, same equipment serves as condenser). Refrigerant is evaporated at temperature lower than outside air, in process, picking up heat from air. Gas is then compressed, fed back to heat exchanger (at relatively high temperature) where it is condensed. Heat picked up, plus heat of compression, heats water in exchanger



3 TWO-STAGE HEATING occurs when outside temperature drops below 20 F. Process is almost same as single-stage heating, except that gas returning from evaporator is compressed in two stages before being delivered to heat exchanger. Single-stage system, operating at low suction pressures required due to low outside air temperatures, would require up to 60 percent more energy to provide heat output of two-stage system

ownership. During the early planning stages, cost estimates of several systems were obtained, and it was found that the air source heat pump system would have the lowest cost of ownership.

Operating cost comparisons were made between the air source heat pump and two other systems. A full analysis indicated that the heat pump operating costs would be less than for either of the other systems. To further check the operating cost analysis, the Niagara Mohawk Power Co., which services the area, will install special watt-hour meters on the system to accurately record the cost of heating and cooling the building. It will take about a year to compile enough data to make a final analysis.

Several heat pump installations were visited prior to the decision to install one. Design changes and improvements noted were incorporated into the Sylvania installation.

It might be noted that there is no special requirement for steam in the building. Hot water for lavatories, kitchens, and cafeteria is supplied by gas fired hot water heaters with an electric resistance booster unit to supply 180 F water for the dishwasher.

250 Ton Cooling Capacity

The research laboratory is a three-story structure with a total floor area of approximately 88,000 sq ft and provisions for a future extension which would add about 10,000 more. The building is completely air conditioned in all areas except the 40 × 40 ft utility wing which houses the heat pump equipment, the electrical substation, and motor control center. The system has a capacity of 250 tons of refrigeration for summer cooling and 2.4 million Btu per hr for winter heating.

The air conditioning system was designed as a single-duct system to supply conditioned air to the interior zones. Located around the building perimeter are 100 percent recirculating, under-window, fan-coil units. Supply fans and combination heating and cooling coils are housed in a roof penthouse. Heating and cooling are accomplished by a hot and chilled

water circulating system which functions in conjunction with the heat pump system.

Zones Have Different Needs

There are two supply fans, each with its own water coil. One fan and coil supplies conditioned air to the second or top floor, while the other serves the first and ground floors.

The second floor, because of the roof above, requires variable supply air temperature to the interior zone. This is accomplished by the separate fan and water coil which delivers air to the space at the required temperature. Because of the high internal load the supply air temperature to the second floor during daytime operation is usually 66 F or below, even during the heating season. This unit is, however, arranged for automatically varying the air temperature to the area as required.

Interior zones on the first and ground floors require cooling even during the winter season, and air is delivered to these areas at a temperature automatically adjusted to the area requirements.

Reduce Cooling Load

Transmission and solar loads around the perimeter of the building are absorbed by under-window fan-coil units having individual thermostatic control. To reduce solar loads through glass areas, sun screens are installed on all windows facing east, south, and west. The sun screens reduce the cooling load on the building by about 30 tons of refrigeration.

A circulating water system furnishes either hot or cold water to the fan-coil units and supply air coils. An outdoor changeover thermostat programs the heat pump to operate on heating or cooling automatically. This changeover occurs at approximately 55 F outside temperature. During the cooling cycle, the circulating water is maintained at a constant 45 F. During the heating season, the water temperature is controlled by an outdoor master controller which programs the water from approximately 80 to 105 F, the higher temperature being reached when it is −5 F outside.

Outside air dampers are set to a minimum opening, and a thermostat, located in the return air ducts, controls the water to the coils.

During intermediate seasons, when the outside temperature will permit atmospheric cooling, the water coil valves are closed, and the outside air and return air dampers are modulated to admit the proper amount of outside air to maintain the desired space temperature.

To conserve on operating costs, the system is programmed so that when the building is not occupied the supply fans stop and the outside air dampers are closed. If the outside air temperature drops below 35 F the supply fans and water coil valves are energized to heat the recirculating room air to maintain the desired temperature. No outside air is introduced into the building during this period.

Two Separate Systems

The heat pump installation itself consists of two separate heat pumps of equal capacity. Each system has two compressors, one high stage rated 125 hp and one low stage rated 75 hp; a heat exchanger for either heating or cooling water; and an outside air cooler or condenser. Each system is separate from the other on the refrigerant side, and is commonly connected only on the circulating water side. Two separate systems were installed in order to make available savings in part-load operation, and, in case of failure of one system, to provide an emergency standby. One system is of sufficient capacity to maintain building temperatures with the outside air dampers closed.

System operation, through its cooling, single-stage heating, and two-stage heating cycles, is illustrated and described in Figs. 1, 2, and 3.

Defrost Evaporators in Winter

During the heating cycle the evaporators become frosted because of the low temperatures at which they operate. Excessive frost must be periodically removed since it decreases the capacity of the system by causing poor heat transfer and reduced air flow by restricting the air stream. The time interval between defrosting cycles can vary considerably, as this is a function of outside air temperature, moisture content, and system loading.

Automatic defrosting controls are set into operation by static pressure trips in the evaporators which sense an increase in pressure drop due to frosting of the coils. The compressors stop and the air fans in the evaporator shut down. A thermal cycle is set up between the evaporator and water heat exchanger so that liquid refrigerant draining by gravity enters the heat exchanger where the liquid is evaporated, picking up heat from the water side. Warm gas then enters the evaporator and melts the frost accumulation, the refrigerant condensing in the process. The drain pan in the bottom of the evaporator has electric heating pads which prevent the freezing of water from the defrosting operation. This water is drained to the sewer.

System Centrally Controlled

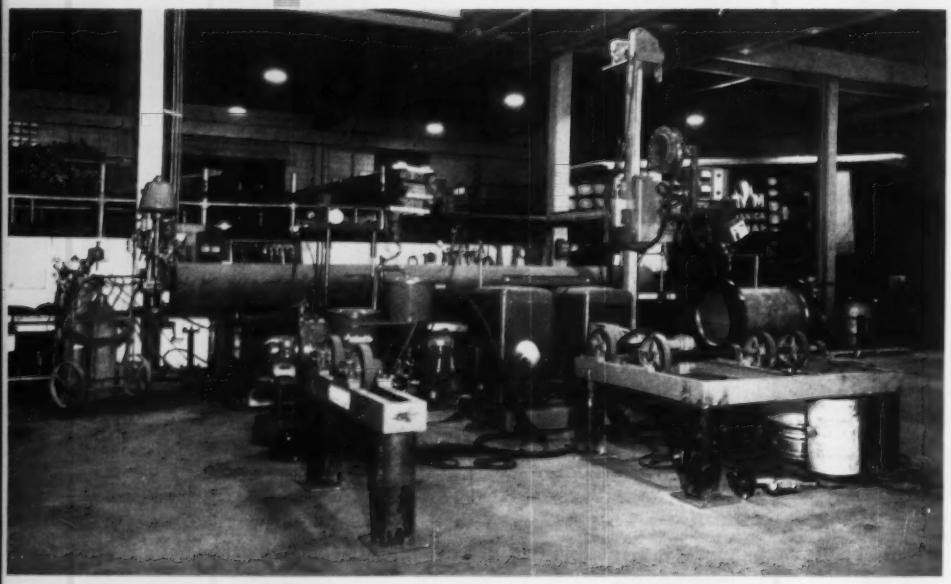
A control center, installed in the utility wing, permits the air conditioning system to be monitored and controlled from one central point. The center features a schematic diagram of the air conditioning and heat pump systems. Indicating lights tell the operator which equipment is functioning. Temperature settings may be made and readings taken for various parts of the building. The entire system normally is set to function automatically by means of a step controller (operating in conjunction with an outdoor thermostat) and program clock.

Satisfactory Operation So Far

The heat pump system has performed satisfactorily to date, although it has been in operation only since April. No major problems have been encountered so far, and it is confidently felt the system will perform equally as well during the critical winter season. ⋕

Submerged Arc Pipe Welding

. . . *say contractors*



1 THIS MECHANICAL pipe welding equipment, used by Wray M. Scott Co., Omaha, has been found to save considerably in manhours necessary for welding large diameter pipe. Automatic turning rolls are used with automatic submerged arc welding head mounted on manipulator for welding pipe 8 to 24 in. diam

2 SAME EQUIPMENT shown in Fig. 1 shown here, in addition to flame cutting pantograph, right, which is used for cutting and beveling large diameter pipe

Equipment Saves Labor Costs

at Mechanical (HPAC) Contractors panel session

AN ACTIVE panel discussion on pipe welding took place at the 69th annual convention of the Mechanical Contractors Association of America, held recently in Los Angeles. William E. Maloney, Buffalo, chairman of the committee on welding, presided at the session.

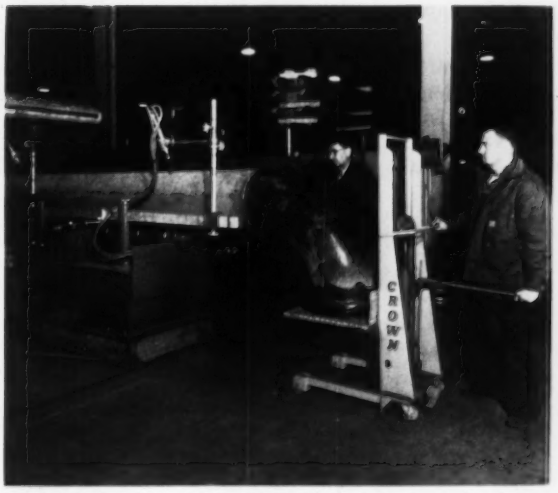
Wray M. Scott, Omaha, chairman of the board of trustees of the National Certified Pipe Welding Bureau, cited the results he has experienced with automatic submerged arc welding equipment for pipe, valves, fittings, and flanges. This testing was done, he said, in an effort to find cost saving methods for accomplishing welds within the limits of the code. Mr. Scott stated that man-hour savings of 50 percent could be effected in welding pipe with submerged arc equipment.

Tests' Results Give Birth to New Spec

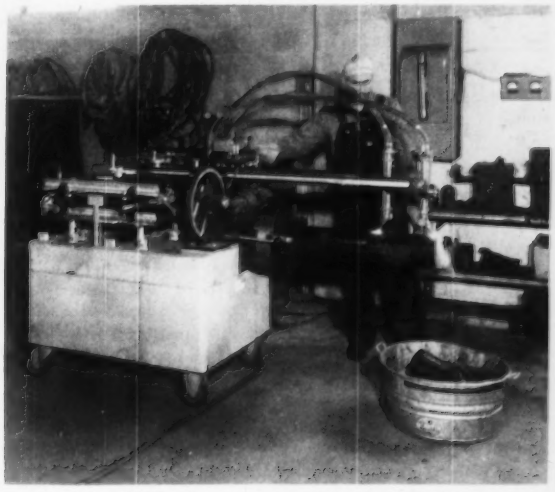
The results based upon these tests have lead to the development of Standard Procedure Specification No. 21 for Automatic Submerged Arc Welding of Carbon Steel Pipe, Valves, Fittings, and Flanges.

Figs. 1, 2, 3, and 4 indicate the type of equipment utilized. Automatic turning rolls are used with an automatic submerged arc welding head mounted on a manipulator for welding pipe from 8 to 24 in. diam. A flame cutting pantograph is used to cut and bevel this large diameter pipe. Also, a small hydraulic platform hoist is utilized in fitting up the pipe and the elbow. After the fit-up is completed, using a backing ring, the work is transferred to the turning rolls. The manipulator positions the automatic welding head. Turning roll and welding head speeds are synchronized, thereby controlling the amount and rate of metal deposit.

A flame cutting mechanical draftsman, which will flame cut and bevel both ends simultaneously or bevel one end and contour cut and bevel the other, may be used to produce a complete shaped nipple in one operation. This mechanical draftsman is designed for pipe sizes from 2 to 6 in. diam. The pantograph is used for pipe sizes from 8 in. diam to 24 in. diam inclusive.



3 SMALL HYDRAULIC PLATFORM hoist is used in fitting up 18 in. pipe and elbow. After fit-up is completed, using backing ring, work is transferred to turning rolls. Manipulator positions automatic welding head. Turning roll and welding head speeds are synchronized to control amount, rate of deposit



4 FLAME CUTTING mechanical draftsman will flame cut and bevel both ends simultaneously, or will bevel one end and contour cut other so that complete shaped nipped is produced in one operation. Unit is used for pipe sizes 2 to 6 in. diam. Pantograph is designed for 8 to 24 in. diam sizes

5 THIS EQUIPMENT, used by L. E. Stevens Co., Cincinnati, has been found to save two-thirds in manhours required to manually weld large diameter pipe. Aluminum piping is also being welded at greatly reduced costs using this same equipment with argon consumable arc

This new Standard Specification No. 21 will be ready for distribution to members of the bureau soon.

Equipment Pays for Itself in First Year

Mr. Scott suggested that other MCAA members consider investing in this type of labor saving pipe welding equipment for their shops. He reported, from experience, that the first cost of this equipment was saved in the first 12 months of operation as a result of manhour savings.

Standard Procedure Specification No. 15 for Inert Gas Shielded Tungsten-Arc Welding of Nickel and Nickel Base Alloy Pipe, Fittings, and Flanges, and Standard Procedure Specification No. 17 for Automatic Argon Shielded Arc Welding of Aluminum Pipe, Fittings, and Flanges will also be available in the near future for distribution to bureau members.

Other standard procedure specifications which are approved by insuring bodies and meet with all requirements of the American Society of Mechanical Engineers and the American Standards Association are:

Standard Procedure Specification No. 1 for Metal-Arc Welding of Carbon Steel Pipe, Valves, Fittings, and Flanges

Standard Procedure Specification No. 2 for Oxyacetylene Welding of Carbon Steel Pipe, Valves, Fittings, and Flanges

Standard Procedure Specification No. 3 for Metallic-Arc Welding of Carbon Molybdenum Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 4 for Metallic Arc Welding of Chrome Molybdenum Alloy Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 5 for Helium Shielded Tungsten Arc Welding of Aluminum Pipe, Fittings, and Flanges

Standard Procedure Specification No. 6 for Metallic Arc Welding of 2¼ percent Chrome and 1 percent Molybdenum Alloy Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 7 for Metallic Arc Welding of Austenitic Stainless Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 8 for Inert Gas Shielded Tungsten Arc Welding of Thin Wall Austenitic Stainless Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 9 for Argon Shielded Tungsten-Arc Welding of Aluminum Pipe, Fittings, and Flanges

Standard Procedure Specification No. 10 for Metal-Arc Welding of Carbon Steel Pipe, Valves, Fittings, and Flanges

Standard Procedure Specification No. 11 for Metal-Arc Welding of Wrought Iron Pipe, Fittings, and Flanges

Standard Procedure Specification No. 12 for Oxyacetylene Welding of Wrought Iron Pipe, Fittings, and Flanges

Standard Procedure Specification No. 13 (reserved)

Standard Procedure Specification No. 14 for Inert-Gas Shielded Tungsten-Arc and Shielded Metal-Arc Welding of Chromium-Molybdenum Alloy Steel Pipe, Fittings, and Flanges

Standard Procedure Specification No. 16 for Inert-Gas Shielded Tungsten-Arc and Shielded Metal-Arc Welding of Chromium-Molybdenum Medium Alloy Steel Pipe, Fittings, and Flanges (alloy group P, No. 5)

Standard Procedure Specification No. 18 (reserved)

Standard Procedure Specification No. 19 (reserved)

Standard Procedure Specification No. 20 (reserved).

Bureau Lists 2000 Qualified Journeymen

W. R. Stevens, Cincinnati, stated that he has semi-automatic submerged arc equipment in operation on one of his large jobs where pipe welding is being carried on at one-third the cost of manual welding. Some of the pipe welded using this equipment and the type of construction involved is shown in Fig. 5. Mr. Stevens also stated that his firm has been welding aluminum pipe on this same equipment with argon shielded arc consumable electrodes at greatly reduced costs.

In addition to the procedures qualified above, it was pointed out that the bureau has a list of over 2000 journeymen who are qualified to do ASME welding under its qualified procedures and that these welders could be interchanged among the members of the bureau without further qualification, as provided by P-116 of the ASME code.

Other contractors reported that they were not far from the in-position mechanical welding of pipe.

Piping Industry Comes of Age

The piping industry has come a longer way than most realize. No longer can the piping contractor carry his tools on his back and his office in his pocket. Fabrication of piping systems today requires the skills of both contractor and journeyman in order to achieve quality welds and assure safety. This is especially true when it is realized that water temperatures in the range of 400 F are being used for heating, and pressures for industrial systems are up in the range of 10,000 psi.

Since the early days of the bureau, Prof. Robert S. Green, Ohio State University, has acted as a consultant to it. The advancement of pipe welding has been promoted through the guidance of Prof. Green and the unselfish devotion of the bureau's board of trustees and its secretary, Joseph C. Fitts. ≠

High Temperature-High Pressure Hot Water Heating Must Be Understood

. . . to achieve its many advantages and to assure reliable operation, stated Harold A. Lockhart, vice president and chief engineer, Bell & Gossett Co., at the recent Mechanical (HPAC) Contractors convention in Los Angeles.

HIGH TEMPERATURE-high pressure hot water* heating is a relatively new tool. Even though the first systems of this kind were used in Europe as early as 1740, this heating medium was not applied extensively in the U. S. until only about 10 years ago.

These systems require a high degree of technical knowledge. A thorough and complete understanding of expansion and contraction of all the metals used is essential, as well as is the pressure and temperature relationship of the water within its operating ranges.

The advantages of a high temperature-high pressure hot water system are:

1) It has the ability to produce power. In other words, a hot water generating system can produce power from the system by its transfer to steam. The system can also supply water at any temperature lower than that required for the distribution system. It can also be used with air conditioning absorption systems.

2) It uses smaller piping.

3) It transfers energy over greater distances. These distances are only limited by the kinds of pumps used. Little attention is necessary to changes in elevation of the piping system.

4) Peak loads can be handled by storage. In this way smaller equipment can be used.

5) It can provide lower maintenance costs.

The disadvantages are:

1) The same safety precautions must be observed that are necessary in high pressure power plants.

2) Licensed operating personnel must be properly trained.

3) Greater care must be exercised in educating engineers in the design; mechanical (heating, piping, and air conditioning) contractors in the installation; and plant and building engineers in the operation and maintenance of these systems.

*For this discussion, high temperature-high pressure means operation at temperatures between 500 and 400 F and at a maximum pressure of 400 psi.

How Control is Achieved

Control is greatly simplified in these systems if pressure control is used rather than temperature control. Because of the relationship between temperature and critical pressure where boiling takes place, slight changes in pressure will cause small variations in temperature. Or, with a very small change in temperature, there will be a greater change in pressure permitting the close control by means of pressure change. For example, if it is desired to maintain a temperature of 400 F, it would be necessary to maintain a pressure slightly over 247 psi.

Temperature control may be accomplished by means of the expansion drum near the top of the boiler. Steam is present in the top of the drum. This expansion drum also becomes an area for water storage below the steam level. The large quantity of high temperature hot water in the drum is available to take care of peak loads as they occur.

As the hot water passes from the expansion drum it goes to the pump. From there it goes directly into the system. It is recommended that a bypass from the return

into the circulating system be used. The reason for this bypass is to permit a lower temperature water to enter the suction side of the pump. This method of bypassing return water takes care of the pump pressure requirements at the pump suction. Steam formation at the pump is thereby prevented.

The degree of system pressure change caused by pump operation is determined by pump head. Whether the pump head will be added to or subtracted from the system static pressure during pump operation is determined by the relative locations of the pump and tank. This is because the junction of the tank (open, compression, or expansion drum) with the system is a point of no pressure change, regardless of pump operation. Consequently, when the tank is connected at the pump suction, the pump suction pressure is relatively unchanged when the pump starts and the pump head appears as a decrease in pressure at the pump suction and on the system.

It is therefore recommended that the pump be connected so as to pump away from the boiler and tank. In

How Temperature, Pressure, Pump Power Are Related in HTHP Hot Water Systems

For a given heating requirement, the temperature drop and water flow rate are directly related. For example, if the temperature drop is doubled, the required gpm is reduced by one-half.

For a given system, the Fanning equation shows the relationship of flow rate and pressure drop:

$$(H_1/H_2) = (Q_1/Q_2)^2$$

where:

Q_1 = original flow rate, gpm
Q_2 = final flow rate, gpm
H_1 = original pressure head, ft of water
H_2 = final pressure head, ft of water

In other words, in any specific piping system, if the flow is reduced by one-half, the pressure head will be reduced to one-fourth of its original value.

The power required to pump water varies as the rates of the capacities to the third power:

$$(P_1/P_2) = (Q_1/Q_2)^3$$

where:

P_1 = original pump power required, hp
P_2 = final pump power required, hp

For example, if the flow is doubled, the corresponding power increase is eight times that originally required.

Temperature drop affects required flow and therefore affects pipe size, pump size, and allowable system circuit lengths. The following examples show these relationships.

1) Assume that a system 2000 ft long is designed for a heat loss of 1 million Btu per hr at a temperature drop of 20 F. For these conditions, 3 in. pipe and a 5 hp pump circulating 100 gpm at a head of 50 ft would be required.

2) If the temperature drop were increased to 200 F from 20 F and if the same pump head of 50 ft were maintained, the system pipe size would drop from 3 in. to 1¼ in. The pump capacity requirement would drop from 5 hp to ½ hp. However, the system heating capacity would remain the same.

3) If the temperature drop were increased from 20 F to 200 F but the system pipe size kept at 3 in., the required pump capacity would drop from 100 gpm to 10 gpm, the pump head to ½ ft, and the power requirement from 5 hp to 1/200 hp.

4) If the temperature drop were increased from 20 F to 200 F, but the pipe size and head maintained at 3 in. and 50 ft, respectively, the required pump capacity would drop from 100 gpm to 10 gpm and the power required from 5 hp to ½ hp. In addition, the length of the circuit which could be circulated would be increased from 2000 ft to 27 miles.

Increased temperature drop therefore permits the designer to do any or all of the following: (1) decrease pipe size, (2) decrease pump head, (3) decrease pump capacity, (4) decrease pump power requirements, and/or (5) increase circuit lengths.

The 200 F temperature drop can be used in the design of these systems today.

In the evaluation of the benefits of increased design temperature drop, the effect on system response time must be considered. The examples given are tabulated below, with the addition of the time required to circulate the system under the various conditions established.

	Example 1	Example 2	Example 3	Example 4
Heat load, Btu per hr	1 million	1 million	1 million	1 million
Temperature drop, F	20	200	200	200
Flow rate, gpm	100	10	10	10
Pipe size, in.	3	1¼	3	3
Pump head, ft	50	50	½	50
Pump power required, ft	5	½	1/200	½
Circuit length	2000 ft	2000 ft	2000 ft	27 mi
Time for water to circulate	7½ min.	13½ min.	1½ hr	4 days

It is suggested that continuous circulation will permit the most satisfactory compromise between all the factors involved. If continuous circulation is used, the piping circuit and expansion drum provide heat storage which can be drawn upon to level off variations in load on the boiler.

this way the pump head will exert a positive pressure on the system. With this type of connection, there is no negative pressure that will exist in the system. If the pump is not connected in this way, considerable trouble may be expected in system operation.

It is essential that adequate water treatment be provided. The pH of the water should never exceed 9. It is especially important to be sure that all the gases are eliminated also.

Special Materials Necessary

In answering a question about valve materials and pump seals, Mr. Lockhart replied that ordinary materials for HTHP systems are not adequate. He suggested that stainless steel, monel, and the more rarefied metals be used for valves. He stated that brass valves have limited application for temperatures over 400 F, and that cast iron valves are unsuitable for these systems.

The types of materials best suited for pump seals have not yet been determined, but a great amount of research is being conducted on this, he said.

When asked what elevations and depressions can be tolerated without air vents in these systems, Mr. Lockhart answered that at least one manual vent should be provided for each high point to permit any excess gases to be liberated. In serpentine panels, a purge valve should be installed for each circuit, he suggested. ‡

SAM LEWIS SAYS...

"Consulting Engineer's Day a Busy One"

A TYPICAL DAY in the life of a consulting engineer—narrated in the hope that it might be suggestive to competitors:

First order of the morning was to advise a building owner how he could correct a problem of dirty domestic hot water. I told him to clean the converter and have a sample of the water analyzed by a chemical laboratory.

Frequently, the cause of this situation lies in the hot water storage tank where water attacks unprotected metal. A good answer in this case is to install a new tank that has an inner coating of glass, cement, or some other protective material.

If no replacement is made, in time the tank will fail. While a hole can be drilled and tapped for a threaded temporary plug, this merely postpones the inevitable replacement of the tank.

• Next, I was called on to settle a question pertaining to a large year 'round air conditioning system. Is it economically justifiable to operate a boiler plant during the summer for reheating air that is refrigerated to its dewpoint?

My stand is against the old wives' tale that it is reprehensible to chill air and then reheat it. Therefore I recommended that the central system air be chilled to the extent of saturation, thereby dropping its dewpoint. This cool air could then be warmed to the extent desired for comfort in each of many small rooms having different orientations and occupancies.

If a client must have minutely differentiated relative humidity and comfort control, let him pay for it!

• An architect in South America is designing a food processing plant in the U.S. He is not paid enough to commute back and forth while administering the construction and the putting into operation of the plant, so he asked me to perform that part of the work for him.

I am not crazy about such an association and division of responsibility, but I believe, after the design is made and the contracts signed, that not more than half of the responsibility would be mine. So I told my friend that I wanted as my fee at least half of what the owner paid him.

• Two boilers in the basement of a home for the aged are engulfed in about 6 ft of water every time there is a heavy rain storm. Low lying electrical equipment for burners and sump pumps require repair several times a year. The original thick masonry walls of the boilers' encasement were starting to crumble.

Additional electric pumps had been used in an attempt to force the water up into the sewer, but the manhole covers in the area floated out of engagement and the pumped-out water ran back into the basement through the doors and windows.

I recommended that a new and larger sewer be built, and replaced the two brick-set boilers with a single boiler of a design so pancake-like that its bottom is 6 ft above the old level. ‡

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.*

BIGGEST AIR CONDITIONING installation ever designed for single commercial office structure is being installed in new Chase Manhattan Bldg., New York, depicted here in architect's model. Systems will supply 9100 tons of cooling capacity to 60-story edifice, now under construction

Unusual Structural Layout Demands Unique Air Conditioning Design

Peripheral zones, interior zones will be conditioned year 'round by high velocity induction systems, medium velocity systems, respectively. Refrigeration equipment is to be located in two equipment rooms with about equal cooling capacity to serve upper, lower portions of building. Absence of interior structural columns posed problem as to where to put ductwork, piping. So these must run through holes in steel beams.

BY WILLIAM HURD HILLYER

THE BEST is not always the biggest. But as a maxim of human affairs, the biggest deserves the best. Hence it is fitting that New York's Chase Manhattan Bank, shortly to be housed in the city's largest completely air conditioned office structure, should be satisfied with nothing short of optimum efficiency and design for its year 'round air conditioning system. Its 9100 tons of cooling capacity is believed to be the largest air conditioning installation ever placed in a single commercial office structure.

Such demand is complicated by problems arising from a unique structural layout. When completed, the bank's central office building will have some 2 million sq ft of usable area. About 500,000 sq ft will be in six extensive floors below a main plaza level. The remaining space will be in an 800 ft tower section having a floor plan measurement of 281 × 107 ft and rising 60 stories above that level.

All areas below the plaza level will be served by air handling equipment located in a fan room in the fourth sub-basement, or approximately 66 ft underground. The air conditioning systems for these below-grade areas will be of the low pressure conventional type. These systems will utilize sprayed cooling coils in order to permit winter humidification.

Three mechanical equipment rooms will be in the tower itself, each utilizing a complete floor at equally spaced levels of the tower. Each room will serve some 20 floors — 10 floors below and 10 above.

The tower is to be of the large-glass-area type having continuous strip windows (of fixed glass, non-operable sash design) approximately 7 ft, 9 in. high around the complete periphery of the building.

High Velocity Serves Periphery

The peripheral tower areas will be air conditioned by high pressure, high velocity, air induction type of systems, with provisions for automatic individual temperature control for each peripheral office.

Each facade of the building is to

be served by its own primary air system and its own secondary water system. This permits complete flexibility of operation as the peripheral loads vary because of the heavily variable solar heat gains through the large glass areas. These variations occur from day to day and from season to season.

Medium Velocity for Interior

Plans call for the interior tower areas to be conditioned by medium pressure, medium velocity systems. Each floor will be served by main trunk ducts running the length of the tower on either side of the central core.

Each main trunk duct will serve, through a number of air pressure reducing valves, a series of low pressure "Christmas tree" duct systems. These dendritic devices are to supply conditioned air through ceiling diffusers. Such a method of air distribution permits varying the supply air quantity to any part of any floor without changing the main trunk ductwork.

Individual floor control of the interior system will be attained by means of automatically controlled hot water reheat coils. Each reheat coil system will be so arranged that it can be extended on any floor (as necessitated by occupancy requirements) so as to permit automatic individual room temperature control in any room.

Improvise Duct Installation

One of the architectural features of the tower is the vast expanse of floor area completely unobstructed by columns. This is achieved by very long columnar spans and deep main girders. As a result of this esthetic feature, there is no room to run ductwork or piping between the bottom of the main steel girders and the hung ceiling below. Therefore all horizontal ductwork and piping on each tower floor must run through holes in the steel beams. In certain areas, these holes will be as large as 7 ft × 2 ft × 4¾ in.

All supply air handling systems are to be served by electrostatic filters, each with its own automatic washing and oiling system.

The total refrigeration capacity installed will be approximately 9100 tons. A refrigeration plant of about 4500 tons capacity will be installed in the lowest equipment room in the tower and will serve the lower third of the tower together with all the areas below the plaza. Another plant of some 4600 tons is to be located in the tower's center equipment room. This plant will supply conditioned air to the upper two-thirds of that edifice.

Each such refrigeration plant will consist of two steam turbine driven compressors, one of about 1100 tons capacity, the other of approximately 3500 tons capacity. Condensate from the condensers serving the steam turbines will be pumped to the cooling tower for makeup water requirement, thereby saving an anticipated half of the cooling tower makeup water requirements.

Use District Steam Service

Steam for the turbine drive and for winter heating, outside air tempering, domestic hot water heating, and kitchen use is to be supplied from the Consolidated Edison Co. district steam service.

Cooling towers and condensing water pumps will be located on the roof of the tower. A certain number of the tower cells will be "winterized" by steam injection systems in the tower pans and sumps and by electric cable heating of the main water lines, thus permitting these cells to remain filled with water during the winter months so that mechanical refrigeration can be provided when unseasonable weather occurs.

Monitor All Operations

Two central control panels are to be installed to monitor all automatic controls and to provide ready information at any time concerning performance of each and every control point in all systems. Each control panel will also mount stop buttons and pilot running lights for all motor driven equipment installed in its area.

One panel is to be installed in the lowest tower equipment room and will monitor all equipment in this room, all floor spaces it serves, and all equipment in equipment rooms below and all spaces below. The other panel will be located in the center tower equipment room to monitor all equipment in that room and all floor spaces it serves, plus all equipment in the equipment room above and all spaces above.

In other words, there will be complete monitoring of all elements of the building's air conditioning systems from the two equipment rooms in which are located the two refrigeration plants.

Control Vibration, Noise

Special attention has been given to the design of the supports and foundations for all equipment with moving parts, to the hangers for all piping connected thereto, and to the acoustic lining for all ductwork. It is believed that vibration transmission and airborne noise have been practically eliminated.

All fans, pumps, and compressors will be mounted on bases employing various arrangements of concrete inertia blocks, combination spring and rubber mounts, and glass fiber pads. All piping is to be hung through combination spring and rubber hangers. Supply and return air handling systems will be equipped with various types of sound traps and acoustic linings to attenuate airborne noise.

Great care was also given to the location and design of the anchor points for the main pipe risers. Due to the extreme height of the building, anchor reactions are very high. In fact, they reach 282,000 psi in one case.

Jaros, Baum & Bolles, consulting engineers, designed this installation. The mechanical (heating, piping, and air conditioning) contractors are Raisler Corp. and Kerby Saunders, Inc., jointly associated for the project. Skidmore, Owings & Merrill were the building architects. Turner Construction Co. is the builder. ≠

RETIRING PRESIDENT John C. Haroldson, Duluth (left) passes gavel to incoming president William G. Gillim, New York

New District Steam Users Stabilize '57 Volume, Sales

. . . reports NDHA at 49th annual meeting

- eight of 92 heating utilities increase basic rates
- new customers buy 2,320,600 M lb of steam
- average gross revenues up 1.5 percent
- adequate rates a necessity

BY JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

A NEW FEATURE of the recent 49th annual meeting of the National District Heating Association, at French Lick, Ind., was the devotion of the entire first day to the meetings of technical and standing committees, at which were considered the statuses of various projects and plans were made for the future.

On the days that followed, at five technical sessions, 15 reports were presented which included 27 papers on district heating subjects. At nine breakfast sessions, groups informally discussed problems of mutual interest.

Report Rate Increases

The rates charged for steam or hot water service in 92 communities in 1957 were reported to the rates and regulations committee by the utilities. These, being applicable in widely scattered areas, reflect extensive variations in plant cost, fuel prices, taxes, wages, climatic conditions, and governmental regulations. Comparisons, therefore, are misleading without consideration of all factors, and may be inconclusive.

Clifford O. Thurlow, rate engineer of Commonwealth Services, Inc., Jackson, Mich., chairman of the committee, reported that during the year steam suppliers increased their basic rates in eight cities and decreased them in one. The estimated percentages of increase in six of the cities were 30, 16, 15, 8, 7.7, and 3, respectively. In one city having three

service classifications—general, demand, and residential—the estimated percentages of increase were, respectively, 0.57, 1.08, and 3.00. In the eighth city the percentage of increase was not computed.

In the one city where a reduction was made, it was estimated to be 5 percent.

In addition to those mentioned, the steam rates in one city were increased an estimated 14.4 percent, effective January 1, 1958.

The rates of most steam utilities include automatic adjustments for changes in fuel costs. In 1957, the chairman reported, fuel costs continued their upward trend, being offset by the added revenue provided by the adjustments.

The smaller suppliers were particularly hard hit by increasing labor and materials costs. During 1957, service to five communities was discontinued.

The committee surveyed the extent of the use of incentive rates. These are rates designed to sell steam during the off-peak season, improve load factors, reduce unit costs, and increase net earnings. Ten such rates were found providing waivers or modifications of demand charges during the nonheating months or a reduced charge per M lb for summer use. The uses found were for air conditioning and summer industries.

Add 455 New Customers

William C. Kaber, industrial engineer with Union Electric Co., St. Louis, made his first report as chairman of the sales development committee. Mr. Kaber said that in 36 of the 52 cities reporting, 455 new customers had been added in 1957, a slight increase over 1956. It is estimated these customers increased the total consumption of steam by 2,320,600 M lb and the revenue by $2,897,851. Both figures are about 16 percent over similar ones for 1956. The estimated average revenue was $1.25 per M lb.

Twenty-five percent of the new customers had used district heating service at some previous time, 52 percent are in old buildings not previously served, and 23 percent are in new buildings.

Seventy-three customers in 10 cities were lost to other methods of heating, a higher number lost than in any year since 1950. However, it should be noted that 50 of the lost customers were in one town where the supplier has notified customers that the system will be abandoned in 1959. The total revenue lost is $178,975 per year, the lowest since 1948.

Boiler capacity to add new customers is inadequate in four cities. But in one of these, additions are being considered for this year. In nine locations a limited number can be served and in the remaining 38 areas, capacity is adequate. Boiler capacity was increased a total of 102 M lb per hr in 1957, which was less than contemplated for that year and less than actually added in 1956. Two cities report that they will add to their plants in 1958.

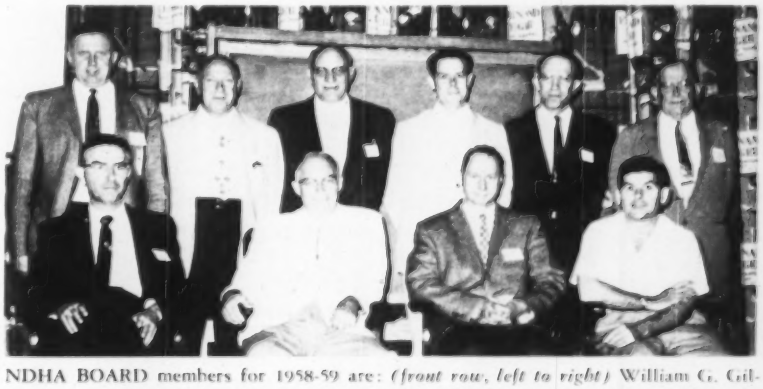
In 39 cities the capacity of the distribution systems is adequate to add customers. In 11 others it is somewhat limited and in one city it is inadequate. Additions were made in 1957 in 18 cities and a like number plan additions in 1958.

For a number of years Foster L. Stephens, steam heating engineer of Allegheny County Steam Heating Co., Pittsburgh, as chairman of the statistics committee of the association, has gathered and reported a group of facts showing trends in the industry. This year 54 steam utilities answered his questionnaire, the largest selling approximately 17 million M lb of steam, the smallest 31,623 M lb.

Mr. Stephens reported that the total steam sold in 1957 decreased 1 percent, probably due to a similar decrease in degree days over the total for the previous year. There was an increase in 1957 of 1.5 percent in average gross revenue per M lb of steam sold. He attributed this to the 3 percent increase in the Btu cost of coal increasing the coal cost adjustment clauses. There was a 0.4 percent increase in steam loss and a 1.7 percent decrease in average load factor.

The normal growth of invested capital of 2.3 percent did not increase the spare boiler capacity, which remained at 14 percent as in 1956, nor did it appreciably change the total line length or radiation surface.

The number of customers served in 1957 decreased 0.4 percent and the number of billing meters was 0.3 percent under the figures for the previous year. However, the connected equivalent direct radiation and the space heated remained as before, indicating that a number of



NDHA BOARD members for 1958-59 are: *(front row, left to right)* William G. Gillim, New York, president; George F. Prestwich, Philadelphia, first vice president; Albert F. Metzger, Pittsburgh, second vice president; Robert C. Wilson, Akron, director; *(back row, left to right)* John C. Haroldson, Duluth, past president; Fred W. Deutsch, Providence, director; Frank C. M. Meyer, Boston, director; James C. Thompson, Atlanta, director; Carl W. Signor, Detroit, director; John F. Collins, Jr., Pittsburgh, secretary-treasurer. Absent were John D. Lemon, Indianapolis, third vice president; and Henry W. Angelery, Northvale, N.J., director

smaller customers were replaced by a lesser number of larger ones.

Streamline NDHA Activities

Speaking as the retiring president of the association, John C. Haroldson, vice president and treasurer of Duluth Steam Corp., Duluth, Minn., said that the primary purpose for annual meetings with technical sessions, breakfast sessions, and committee gatherings is to help members keep abreast of developments.

He said that one of the big steps forward taken by the association in the past year has been the establishing of three divisions within the executive board—one for advisory and planning matters, one for operations, and one for administrative and financial matters. Prior study by these groups, it is expected, will streamline board procedure and improve the type and scope of subject matter going into the technical papers.

Under the adopted schedule, subjects for study will be approved 12 months ahead instead of eight and one-half months before presentation, and the annual meetings, formerly three and one-half days long, will be compressed into three days.

The president commented on the effect of adding air conditioning in improving load factors and said that the establishment of rates to bring adequate and fair returns on invested capital is necessary if the industry is to become and remain a healthy, growing, profit-making part of the overall corporate picture.

John F. Collins, Jr., secretary-treasurer of the association, gave a detailed report on the activities of the organization, and stated that, at the year's end, the financial condition of NDHA was excellent.

Fred W. Deutsch, sales manager of Builders-Providence, Inc., Providence, R. I., chairman of the membership committee, reported that, although there was considerable turnover in membership caused by deaths and due to other reasons, the new members secured balanced the losses.

Name New Officers, Directors

Following his unanimous election as president of the association for the coming year, William G. Gillim, assistant superintendent, customer service, steam service operations of Consolidated Edison Co., Inc., New York City, was handed the gavel of authority at the last meeting by retiring president Haroldson.

George F. Prestwich, superintendent, coal bureau and steam heating division of Philadelphia Electric Co., was made first vice president. Albert F. Metzger, supervisor of steam utilization of Allegheny County Steam Heating Co., became second vice president. John D. Lemon, administrative assistant, Indianapolis Power & Light Co., was elected third vice president.

Three new directors elected for two-year terms are Mr. Deutsch; Frank C. M. Meyer, head of steam sales and service division, Boston Edison Co.; and Carl W. Signor, personnel coordinator, central heating department, The Detroit Edison Co.

Five other directors continue in office: Mr. Haroldson; Mr. Collins; Henry W. Angelery, president, Aerco Corp., Northvale, N. J; James C. Thompson, heating sales engineer, Georgia Power Co., Atlanta; and Robert C. Wilson, steam heating sales and distribution engineer, Akron division, Ohio Edison Co.

The golden anniversary meeting of NDHA is to take place during the first week of June 1959 at the beautiful Skytop Club in the Pocono Mts. of eastern Pennsylvania.

Reports on the technical papers presented at the past meeting will be published in a future issue of Heating, Piping & Air Conditioning. ≠

Roof Ventilation Formula Aids Plant Fire Control

A FORMULA for emergency roof ventilation of industrial plants to aid fire control and minimize damage has been reported by General Motors Corp.

John J. Cronin, vice president in charge of GM's manufacturing staff, said the formula evolved from studies by Armour Research Foundation, Illinois Institute of Technology.

Measurement of heat vented through roof openings in a scale model building outfitted with fire and smoke generating apparatus appeared to represent with reasonable accuracy the relative quantities of heat that would be vented from a full scale building, Mr. Cronin said.

Purpose of the tests was to find out whether special ventilators or conventional monitors — or both — on industrial building roofs provide safeguards against accumulating smoke and hot gases over a fire area.

Mr. Cronin said the results showed that monitors or ventilators, combined with draft curtains of sheet metal or other noncombustible materials, at specified intervals within a roof area would vent smoke and hot gases with sufficient effectiveness in an emergency to aid fire control.

In brief, the formula outlines vent-to-floor area ratios which are related to the particular degree of fire hazard involved in a plant or certain areas of a plant. A similar ratio for use of draft curtains over various size building bays — also depending on the degree of hazard — is provided for.

In effect, draft curtains in prescribed locations on the underside of the roof, fence off ceiling areas to confine the smoke and hot gases within zones from which they can be vented via monitors or roof ventilators. ≠

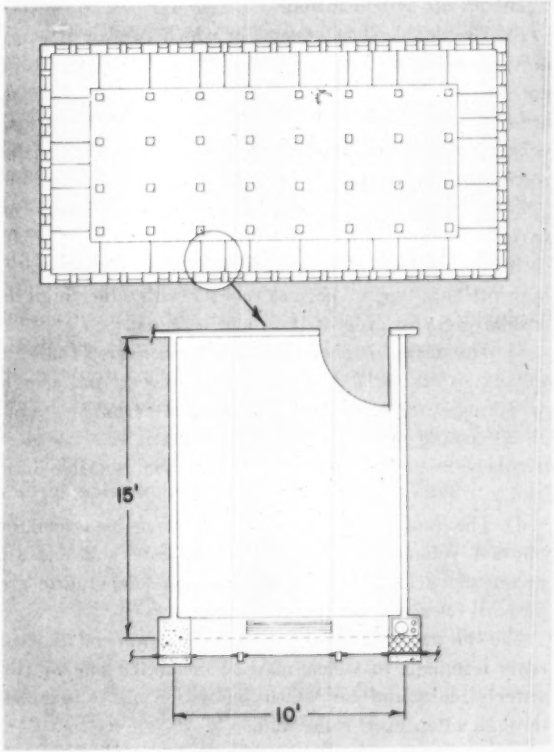
How to Select Right Air Conditioning System for Multi-story Building

The four main types of air conditioning systems for multi-story, multi-room buildings have certain performance limitations under various operating conditions. And, of course, their installation and operating costs vary. Selection of the right system for a given building involves weighing the capabilities of these systems against their economics. The author, through cost information and rating the systems functionally, has derived a method for equating system performance and overall costs.

Some other ideas advanced by his study are:

- **the graphic determination of year 'round sensible load variations**
- **a practical value for solar radiation load effects**
- **the importance of determining the sensible load per square foot in selecting a system**

BY M. J. WILSON
Product Specialist
Machinery and Systems Div.
Carrier Corp.



1 TYPICAL FLOOR PLAN and module detail of multi-story, multi-room building shown here. Module may be peripheral area of block type of office building, hotel guest room, or hospital patient room

A YEAR 'ROUND comfort air conditioning system should maintain throughout the year the desired temperature, an acceptable relative humidity, filter effectively the air introduced to the conditioned areas for dilution or "flushing" of odors, and should produce a uniform air motion in the space. The noise contribution by the system or equipment when operating should not exceed established criteria for the specific type of usage.

The conditioned areas in the multi-story, multi-room building, especially the commercial office type, are usually classified as interior areas and exterior. The interior areas have a uniform and "positive" cooling load throughout the year. The exterior or peripheral areas

have variable loads which fluctuate during the year from "positive" to "negative," depending on outside effects.

Any system usually considered for peripheral year 'round air conditioning will provide an acceptable air motion in the space. We know of none that will neutralize completely and effectively the "cold wall" or radiant heat loss in winter due to large glass areas.

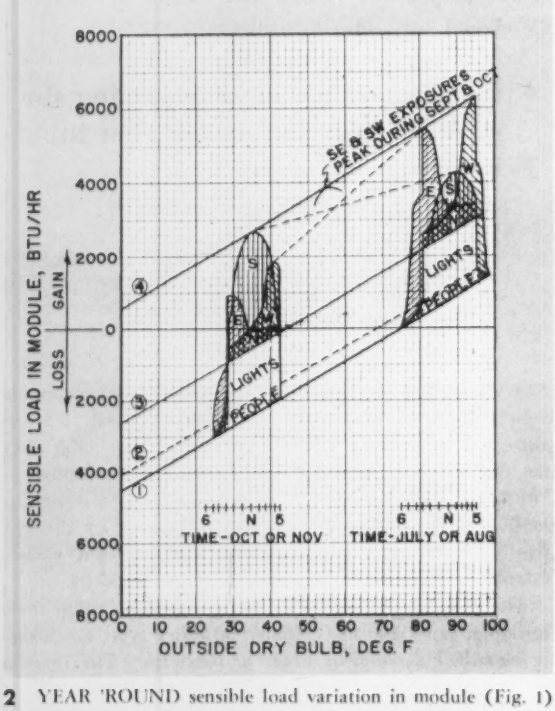
Any of the systems which, by design, separate the latent and sensible cooling functions can maintain the room relative humidity within acceptable limits. Noise contribution to the conditioned space depends to some extent on the type of system. Air quality is a function of the dilution rate or "flushing" and the effectiveness of the filtering elements.

Temperature variations in the peripheral areas result from the wide fluctuation in sensible heat gains and losses due to outside effects. Some types of systems cannot provide simultaneously the sensible heating and cooling capacity required to neutralize these variables.

Since dry bulb temperature is the most important factor in our sensation of comfort, this study will show graphically the limitations of some systems with respect to maintaining desired temperatures in conditioned areas.

System Types Fall into 4 Main Categories

There are many different types of systems being designed and installed today in the multi-story, multi-room type of building. Generally speaking, they fall into four main categories:



2 YEAR 'ROUND sensible load variation in module (Fig. 1) charted. Daily load curves represent directional exposures

1) *Air-water* systems such as the induction type
2) *All air* systems such as the double duct
3) *All water* systems such as the fan-coil
4) *Refrigerant* systems using the self-contained window unit.

The foregoing classification indicates the method used for extracting from and adding to the conditioned space both the sensible and latent heat.

The *all air* and *air-water* systems are further classified as high or normal velocity. A high velocity system is one in which the air side distribution velocity is in excess of about 2200 fpm. The velocity is purely a question of economics and does not seriously affect the functioning of the system except for the slight possible change in room noise level. In addition, these two basic types of systems may be further classified as high pressure or normal pressure, depending on whether the pressure drop at the terminal is in excess of 0.25 in. water gage.

The *air-water* systems may be further classified as follows:

1) An induction system using a high velocity, high pressure, constant volume air supply to a high induction type of terminal

2) The radiant panel terminal in ceiling or wall with constant volume air stream at high or normal velocity, and high or normal pressure drop at the terminal

3) The fan-coil type of terminal with supplementary constant volume air supply at high or normal velocity, and high or normal pressure drop at the terminal.

The *all air* system includes:

1) The double duct system, in which two air streams of variable volume and sometimes variable temperature are available to each conditioned space. (These systems are either the high velocity, high pressure type or normal velocity with either normal or high pressure drop at the room terminal.)

2) The single duct system in which one air stream of variable volume and variable temperature is supplied to each area. (These systems may also be the high velocity, high pressure type or normal velocity with either high or normal pressure drop at the room terminal.)

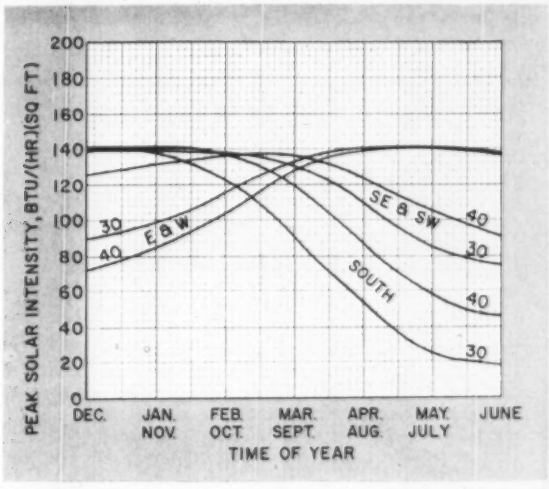
3) The terminal reheat type of system having constant volume air stream at high or normal velocity and a high or normal pressure drop at the reheat terminal. (This *all air* cooling system may use either steam, water, or electric heaters to maintain a constant room sensible heat load.)

4) The *dual-conduit* system in which one air stream of constant volume and variable temperature and one air stream of variable volume and constant temperature are supplied to each of the peripheral areas.

The *all water* systems are those with fan-coil type of room terminals to which may be connected one or two water circuits and for which ventilation air is obtained through an opening in the wall.

The *refrigerant* systems are those which utilize the self-contained reverse cycle window or in-the-wall units for extracting or adding the heat.

The sensible cooling and/or heating load in the ex-



3 SOLAR HEAT GAIN during 3 hr period of maximum intensity analyzed for 30 to 40 deg north latitudes. Chart applies to any exposure receiving direct solar radiation

terior areas or modules of a multi-story, multi-room type building consists of: transmission, solar radiation, lights and other electrical equipment, and sensible heat from people.

Transmission through the glass and wall is the only one of these four components of the room sensible load which "reverses." Specifically, at certain times of the year the transmission component is positive and there is a sensible heat gain to the space. At other times the heat flow has reversed and this component of the sensible load is negative.

In other words, in summer additional sensible heat must be extracted from the area to maintain the desired temperature, and in winter heat may have to be added depending on the net effect on the sensible load due to sun, light, and people. The reversal of this component of the room sensible load complicates the problem of maintaining proper temperatures. This is especially true in the so-called intermediate season.

If a year 'round air conditioning system were designed so that it would neutralize or "wash out" the effects of transmission, then the problem would be much simplified because the remaining components are always positive. The net effect would be a variable cooling load throughout the year. This is most significant, especially when studying the requirements of an air conditioning system. A system so designed should offer certain advantages from the operation standpoint and quite possibly in first cost.

Any year 'round system which provides two media or two fluids to the conditioned space can achieve this result. For example, an *air-water* system can utilize either the air or the water — preferably the air to neutralize transmission throughout the year. The water could be cold and could offset the heat from sun, lights, and people for the entire year. In an *all air* system one of the air streams could be made to perform the same function.

How does the year 'round sensible load which occurs in a typical exterior office or room vary? Fig. 1 is a typical floor plan and module detail of a multi-story, multi-room building. The module may be the peripheral area of a block type of office building. It may be a hotel guest room or a hospital patient room. It is a module of approximately 150 sq ft in area. The glass area is approximately 40 sq ft.

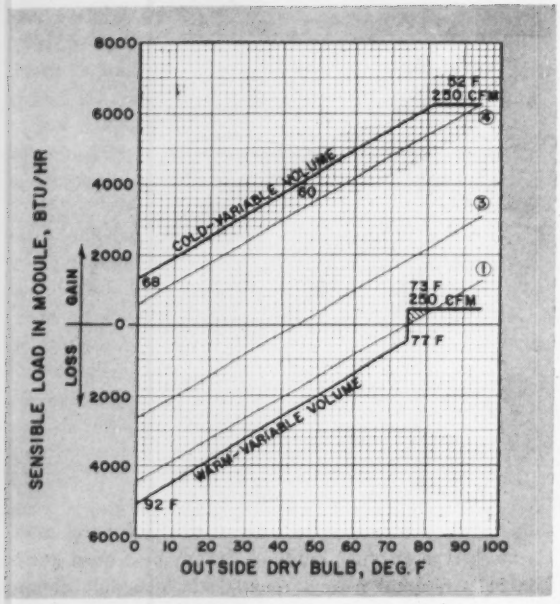
Fig. 2 shows the year 'round sensible load variation in the module. Curve No. 1, the lower line, represents transmission, which is positive during those times of the year when the outside dry bulb is above the room design. Conversely, it is negative during the times of the year when the outside dry bulb is below room temperature. The outside dry bulb temperature is shown at the bottom. The vertical scale is the sensible heat gain or loss to the module shown in Fig. 1.

The gain or loss due to transmission is a function of temperature difference across the glass and wall. The slope of this line will change with different heat flow rates, namely different glass ratios.

For simplification, it has been assumed that the inside room dry bulb remains constant through the year at 75 F. Consequently, the transmission curve No. 1 becomes a straight line. Another assumption to simplify the analysis, although not exactly correct, is that a stable flow rate exists. Curves Nos. 2 and 3 are people and light loads, respectively. Curve No. 4 is a summation of all four components, including solar radiation. The solar heat gain component will vary through a wide range depending upon the glass ratio and other factors such as shading devices or heat absorbing sections.

Curve No. 1 also represents the sensible load in the unoccupied room, since the only effect is transmission. Curve No. 3 is the occupied room with lights, but without solar radiation. Curve No. 4 is an occupied room with sun. This identification of the various loads will prevail throughout the analyses given in this article. The range of loads or the extremes that must be neutralized by any air conditioning system to maintain the proper temperatures is the area between Curves Nos. 1 and 4.

Also indicated in Fig. 2 are the daily load curves for directional exposures. The solar radiation component is



4 AVAILABLE sensible heating, cooling capacity of *all air* double duct system of conventional design analyzed

substantially the same for all exposures which will, at one time or other throughout the year, be subjected to direct solar radiation. For example, the solar heat gain to a module with an east exposure is the same as that for one facing west. It occurs, however, at a different hour of the day and with a lower coincident dry bulb temperature.

The intensity on a south exposure is the same as for the east and west. However, it occurs at a different time of the year. Note on the right of Fig. 2 the daily load curves for various exposures that occur on a summer day.

The daily load curves shown at the left are for a day in winter. The peak solar intensity for a southeast and southwest exposure occurs during the intermediate season as indicated.

The extremes of year 'round sensible load which are shown here may be used to check the required capacities of the various systems. Remember, Curve No. 1 is the unoccupied room, Curve No. 3 is the occupied room with lights but without sun, and Curve No. 4 is the occupied room or module when exposed to solar radiation. As mentioned earlier, these load curves are the basis for the system evaluations which follow.

Analyze Solar Heat Gain Components

The solar heat gain components of the load as shown by Curve No. 3 is approximately the same for any exposure. This is explained in Fig. 3. This chart is an analysis of the solar heat gain during the 3 hr period of maximum intensity. It is for latitudes 30 to 40 deg north which, for practical purposes, represents the continental United States (excluding Alaska). It applies to any exposure receiving direct solar radiation. This means that at some interval during the day and on some day of the year the intensity is practically the same for any exposure having direct sun.

Note that the east and west peaks are during the summer while other exposures reach their maximums later in the year. It follows therefore that a single value for solar heat gain, as shown by the peaks of these curves, could be used when determining the load in any module or room exposed to the sun.

Fig. 4 is an analysis showing the available sensible heating and cooling capacity throughout the year from the two air streams in an *all air* double duct system of conventional design. The heavy line at the top of the chart shows the potential cooling capacity from the cold trunk. The heavy line in the lower portion represents the available heating capacity in the neutral or hot duct. The vertical scale on the left is the Btu gain or loss to the module. The bottom scale shows the outside dry bulb temperature throughout the year.

The load curves are: No. 1, the unoccupied room; No. 3, the occupied room with lights; and No. 4, the occupied room with lights and sun. The supply air temperature schedule for each air stream is indicated. Note that the cold trunk supply air temperature is 52 F when maximum cooling capacity is required. Also note that 250 cfm must be supplied to this module to absorb the design heat load. The temperature in the neutral trunk at this time would be 73 F.

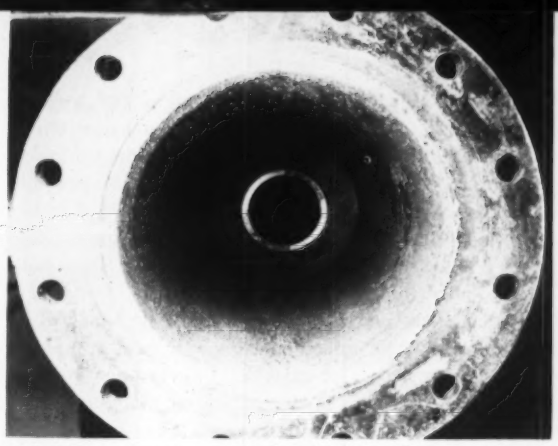
Assume a load such as shown by Curve No. 3. The load is approximately 3000 Btu with a 95 F outside temperature. The supply air quantity will remain at 250 cfm by mixing the 73 F air in the neutral trunk with the proper amount of 52 F air available in the cold duct. The mixture temperature would be 64 F, with 57 percent of the air from the neutral trunk and 43 percent from the cold trunk.

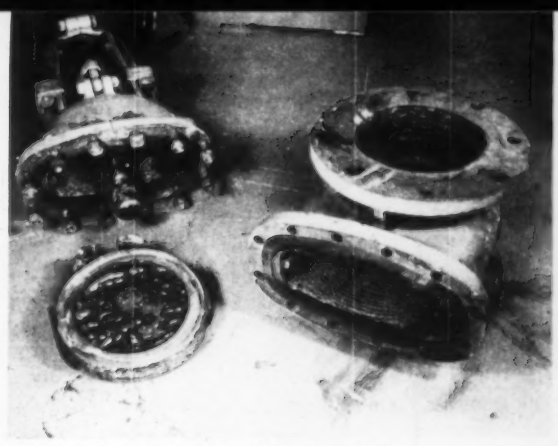
The ratios may be readily determined for any load point throughout the year. The neutral trunk temperature remains constant at 73 F during one phase of operation, as indicated by the horizontal line at the right of the chart. This will occur if no steam nor condenser water heat is available.

The shaded area at the right is the theoretical deficiency in heating capacity from the neutral trunk. It indicates that slight overcooling of an unoccupied room would occur. This is of no great significance except to point up the fact that proper temperatures must be maintained in both trunk systems when such wide extremes of loading occur. In other systems these areas increase appreciably. In other words, some systems do not provide the required simultaneous capacity during certain seasons of the year.

This type of system can maintain proper temperatures the year 'round because of the inherent advantages of supplying two full volume air streams to each module.

The available capacities of the dual conduit *all air* system and of the various *air-water* and *all water* types will be described and charted in the next article to be published in an early issue. ≠





PRIMARY SYSTEM was fabricated from ordinary steel piping. After only few month's operation evidence of rust condition appeared, as shown in 12 in. discharge piping (left), 12 in. gate valve in discharge line (right). Piping was sandblasted, coated with ¼ in. hard gum rubber lining. No apparent deterioration has been observed thus far, but time will tell

What to Consider When Designing Piping for Nuclear Processes

BY W. R. DUNBAR, W. K. LUCKOW, and J. L. SHAPIRO
Phoenix Memorial Laboratory, University of Michigan

THE EXPANDING ACTIVITY in the atomic energy industry is bringing an increasing number of engineers and contractors into direct contact with the special requirements of this field. The process system of the Ford Nuclear Reactor at the University of Michigan represents a particular example of the general work a consulting engineer and mechanical (heating, piping, and air conditioning) contractor might be expected to perform.

The uniqueness of the problems associated with installation, operation, and maintenance varies with reactor design and function. However, the focal point for departure from conventional practice centers around the presence of radioactivity. Consideration must be given to the effect of radioactivity on the process system itself and to the potential radiation hazards that operation and maintenance procedures may induce.

Two basic points must be considered when selecting piping materials for a process system for a reactor design similar to the Ford reactor:

1) Any pipe, heat exchanger, valve, or tank which must carry reactor pool water must be capable of continuous contact with low conductivity, oxygen saturated water for long periods with a very low rate of corrosion. Aluminum and stainless steel are commonly used.

2) The piping materials must be capable of withstanding large doses of gamma radiation without physical damage. This precludes the use of plastic pipe and those types of rubber liners which deteriorate upon exposure. Since none of the process systems will normally be exposed to neutrons from the reactor core, consideration need not be given to the radioactive half life of radioisotopes formed from the chemical elements in the piping materials. Aluminum is usually used at and in the immediate vicinity of the reactor core since radioactive aluminum has a half life of only a few minutes.

Another point to consider is not unique but does de-

Definitions

Isotope: One of several types of an element, differing in the number of neutrons in its nucleus. All isotopes of an element behave identically in chemical reactions but differently in nuclear reactions.

Radioactive isotope: An isotope which is unstable. It tends to decay, or transform itself into a new, more stable isotope. In doing so, it releases energy in the form of radiation.

Induced radioactivity: The radiation released by radioactive isotopes which have been made by bombarding stable isotopes with neutrons.

Fission: The splitting of the nucleus of an element into two fragments. Fission may occur spontaneously or may be induced by the capture of neutrons. In addition to the fission fragments, neutrons and gamma rays are usually produced during fission.

Roentgen: A unit of X or gamma radiation intensity based on the energy absorption in air.

Roentgen equivalent physical (rep): A unit of radiation absorption based on the energy absorption in human tissue. (Millirep = 1/1000 rep; megarep = 1 million rep.) To give an idea of the magnitude of this unit, the allowable dose to humans has been set at 300 millirep per week (of gamma rays).

serve stress. Assembly of the process system does not require custom made fittings nor new and novel techniques. Conventional but sound engineering practice, followed by careful workmanship during assembly will satisfy the requirements of the system with very few exceptions. An orderly and completely accessible layout is imperative.

Finally, consideration must be given to the placement of the various parts of the process system within the building. All parts which store or transport radioactive water must be located in unoccupied areas and have adequate gamma radiation shields.

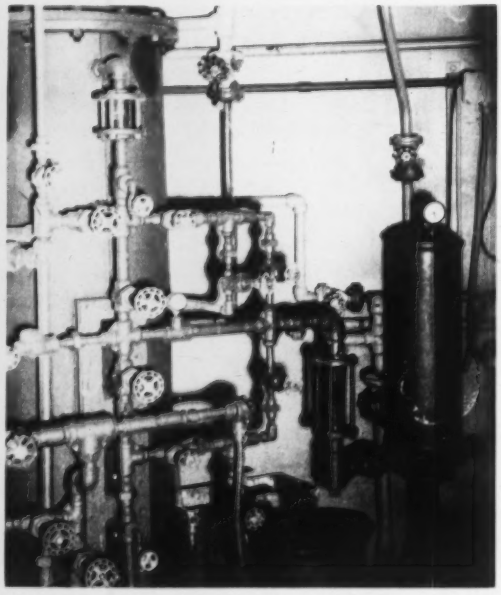
The Ford reactor's 12 in. piping carrying pool water to and from a heat exchanger is seamless and welded schedule 40 ASTM A-53 carbon steel with a ¼ in. thick hard rubber lining. Care was exercised during assembly to insure leak tightness around flanges, but no special procedures were adopted to guarantee an absence of leaks since it is presently felt that small leaks will be tolerable. Piping of the same size to a cooling tower does not have the rubber lining.

All valve stems are readily accessible. Pipe bends with minimum radii of five pipe diameters were used in preference to fittings where practicable. Underground piping was given an asphaltic coating, wrapped in heavy kraft paper, and waterproofed with an asphaltic coat.

How the Ford Reactor Operates

The Ford Nuclear Reactor is a swimming pool type of research and educational facility with a maximum power rating of one megawatt (3,413,000 Btu per hr).

It consists of a 41,000 gal pool of water with the reactor core suspended in the water from a mobile bridge. The core is made up of uranium bearing fuel elements, each of which contains 18 curved fuel plates brazed into aluminum side plates to form a box 3 in. square and 30 in. tall. The neutron and gamma radiation emitted by the reactor core is utilized for experimental investigation. The heat produced by fission is incidental in this research reactor and is dissipated to the atmosphere. Much of the process system is concerned with drawing pool water between the fuel plates to remove the heat, removing the radioactivity induced by neutron capture in the water, cooling the water, and returning it to the pool.



POOL WATER is continuously recirculated at 20 gpm through 6 cu ft mixed bed ion exchanger to maintain dissolved solids at less than 1 ppm. Water purity is necessary to minimize corrosion, maintain low salt concentration to combat induced radiation, afford high visibility which permits accurate manipulation of fuel at bottom of pool

At high power levels, 1000 gpm of pool water is drawn down through the core to the basement underneath the reactor. This is accomplished by means of a header and a 12 in. pipe. There, the water flows through a 1000 gal retention tank designed to permit the decay of radioactive nitrogen formed inside the reactor core by the absorption of neutrons in the water. The water then flows to the primary side of a heat exchanger. From there it is returned to the pool through a diffuser on the pool floor. A three-cell, three-fan cooling tower on the roof of the building services the secondary side of the heat exchanger at 1000 gpm.

Pool water is continuously recirculated at 20 gpm through a 6 cu ft mixed bed ion exchange column to maintain dissolved solids at less than 1 part per million. This purity of water is required to minimize corrosion of the aluminum clad fuel elements and the other metal parts of the reactor. A low salt concentration is also required because of the radiation hazard that could arise from the absorption of neutrons by the various salts. Another important feature of pure water is the high visibility that it affords, allowing accurate manipulation of fuel at the bottom of the pool.

Untreated city water is used on the secondary side of the heat exchanger since this water is exposed neither to the reactor nor to the neutrons emitted by the reactor.

Piping mains and branches are supported by means of wrought steel clevis type hangers. Those suspended from overhead slabs, roof construction, etc., are supported by standard expansion pipe hangers, except where special hangers are required. Vertical pipes are supported by friction clamps.

Pumps for the pool water and cooling tower systems are vertical, single stage, centrifugal units with 1000 gpm capacities, and are water lubricated.

The heat exchanger vessel is 21 ft long × 29 in. OD and is fabricated of type 304 stainless steel. The reactor pool water flows on the shell side and the secondary (cooling tower) water is conveyed through 354 U-shaped tubes of ½ in. OD.

Should the reactor pool water become excessively radioactive, the use of a heat exchanger would prevent spraying radioactive water into the atmosphere at the cooling tower since the two water flow circuits are independent of each other. The pool water has an equilibrium temperature of 90 F, rising to about 100 F on passing through the core.

Combat Rust Problems With Rubber Lining

The demineralizer loop is fed by aluminum pipe. Originally, the loop was of ordinary steel piping. However, this material proved to be unsatisfactory since it was found to be rusting.

Likewise, the primary system was originally fabricated from the same material (except for the heat exchanger). After a period of operation of only a few months—even before the reactor was initially started up—cloudy water was observed diffusing into the pool whenever the primary pump was turned on. Upon shutting down and investigating, a rust problem was found here, also.

Therefore this piping was sandblasted and coated with a ¼ in. lining of hard gum rubber. Samples of this rubber were first tested for radiation damage by irradiating them in a Co^{60} gamma facility. No apparent deterioration of the rubber was observed after a dose of about 24 megarep was administered, although some gas was evolved from the samples. The ability of the hard gum rubber lining to stand up in this application will be determined by experience.

When it was first installed, this primary loop was fabricated with welded joints to eliminate the possibility of radioactive leakage. These welded joints had to be cut and flanged in order to add the rubber lining. To date, no problems have been encountered due to leakage through the flanges. As with the hard gum rubber lining, only future operation will indicate the desirability of flanged or welded joints.

Provide for Pool Water Storage, Treatment

Ion exchange resin for pool water purification is contained in a stainless steel tank. Provision is made so that potentially radioactive leaks will flow from floor drains to a "hot" sump. The contents of this sump may then be pumped to a 9000 gal reservoir in the adjacent laboratory building for storage or treatment.

A second and independent demineralizer tank with city water input is available for adding makeup water to the reactor pool and for providing demineralized water to the various laboratories. This water is also used to fill the beam ports. These ports are kept full of water for radiation shielding purposes.

In the event of a major leak the entire pool would be contained within the reactor basement. There are no gravity fed drains to the sewer. Floor drains throughout the building flow to either of two sumps in the basement. Under normal operation the flow is diverted to a "cold" sump which is monitored continuously. If the radiation monitor exceeds a preset level, the sump pump is automatically disconnected.

If an operation arises on the laboratory floor in which radioactively contaminated water must be discharged into floor drains, valves on the floor drains enable the flow to be diverted to the "hot" sump. The contents of either sump may be pumped to the large reservoir for processing. To further isolate the building there is a siphon break in the building discharge line to the sewer line and a backflow preventer in the main city water feeder to the entire feeder.

Radiation Detector Shuts Down Ventilation

Conventional piping is used to provide the normal laboratory services of hot and cold water, low pressure steam, compressed air, vacuum, gas, and ventilation.

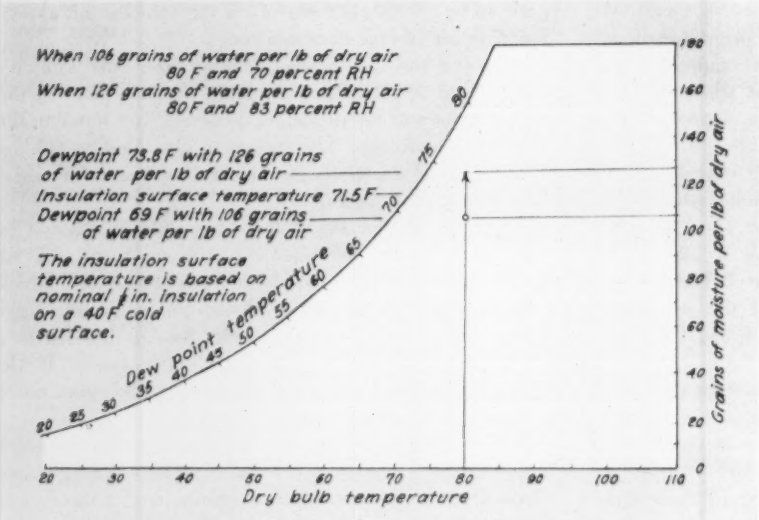
Intake and exhaust air for building heating and ventilating is controlled by two dampers 5 ft in diameter.

A radiation detecting chamber in the ventilation exhaust air plenum continuously monitors the air being discharged into the atmosphere. A high radiation reading sets off a building alarm, drops the steel dampers upon a soft rubber gasket, and shuts down the inlet and exhaust fans. Thus, the entire building can, if the air becomes contaminated, be sealed off on such short notice that less than 10 percent of the air volume in the building leaks out in a 24 hr period.

There are no windows in the reactor building and no doors leading directly to the outside. All but two of the entrances to the adjacent laboratory building are sealed shut during reactor operation. Conduit and other piping leading into the reactor building were carefully caulked to prevent air leakage around or through the pipes. A dehumidifier within the building controls the humidity of the air during the summer months. Steam for heating is supplied by an oil fired boiler in another building.

Although the comments and descriptions in this article are based on the swimming pool type of reactor, the general principles and design criteria for the process system apply to most water cooled reactors.

The Ford Nuclear Reactor was designed by Smith, Hinchman, and Grylls Associates, Inc., architects and engineers. The mechanical (heating, piping, and air conditioning) contractor was Kaighgin and Hughes, Inc. ✠


When 106 grains of water per lb of dry air
80 F and 70 percent RH
When 126 grains of water per lb of dry air
80 F and 83 percent RH
Dewpoint 73.8 F with 126 grains
of water per lb of dry air
Insulation surface temperature 71.5 F
Dewpoint 69 F with 106 grains
of water per lb of dry air
The insulation surface
temperature is based on
nominal ½ in. insulation
on a 40 F cold
surface.
Dew point temperature
Dry bulb temperature
Grains of moisture per lb of dry air

1 SIMPLIFIED PSYCHROMETRIC CHART shows what happens when water is added to sample of air. Values plotted reveal that insulated 40 F chilled water line will remain dry in air with 106 grains of moisture per lb of dry air, but will sweat badly in air to which water vapor has been increased to 126 grains per lb

What to Watch For When Insulating Air Conditioning Systems

Just because the insulation of one system is successful doesn't mean that another like it will not fail. Many causes of unexpected high dewpoints and depressed dry bulb temperatures exist which must be thoroughly investigated and, where found, corrected if an installation is to be satisfactory.

BY CHARLES F. GILBO
Research and Development Center
Armstrong Cork Co.

UNEXPECTED high dewpoints and/or depressed dry bulb temperatures (air chilling) can cause a sweating problem in air conditioning installations as readily as improperly installed or inadequate insulation.

Although it is true that failure sometimes occurs on low temperature installations because of poor workmanship, low quality material, or insufficient insulation, it is possible for two installations to be identical in specifications and have one be successful and the other fail.

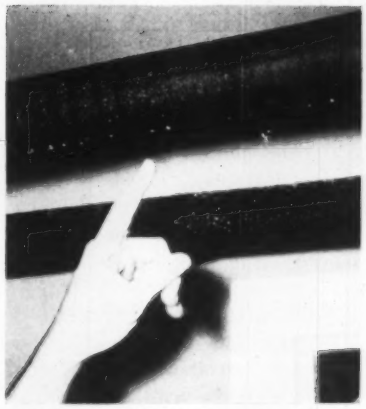
A study was made recently of installations that had failed because of excessive condensation. They appeared to be no different from identical jobs that had been successful.

One study concerned two motels that were approximately the same size and were equipped with similar year 'round air conditioning systems. There were no visible indications in either job that a severe problem of sweat control existed. Yet, one installation failed so badly that the damage accredited to the sweating of the air conditioning system amounted to $20,000. Meanwhile, the other installation was successful.

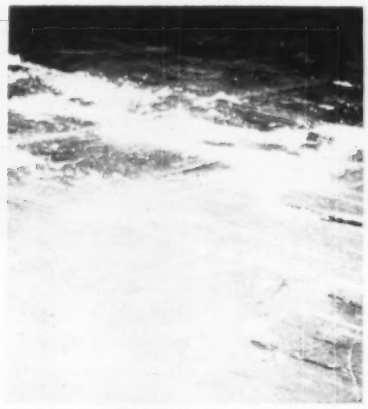
Other studies were made at a small hospital and at a refrigerated warehouse.

What Causes Condensation?

As previously mentioned, there are two major reasons for the unexpected failure of insulation to prevent sweating—the dewpoint of the air is higher than would be expected or



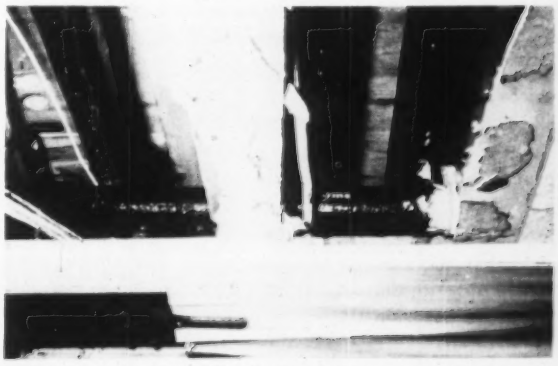
SMALL HALLWAY connects two restrooms directly above tunnel where saturated air is discharged. Hot, humid air entering via holes in floor through which cold water pipes enter causes high dewpoint and, therefore, condensation



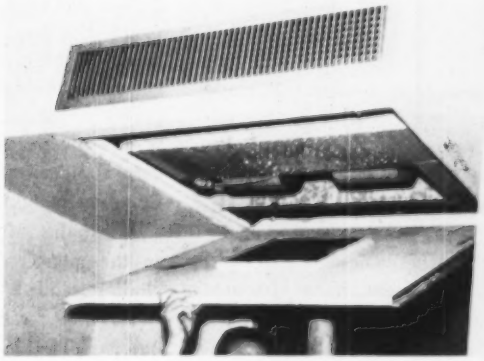
EFFLORESCENCE left by evaporation of moisture in motel basement recreation room pushed tile from floor. In some cases salts grew as much as 2 in. above floor level. Moisture also caused water stains on walls

ANOTHER FLOOR showed signs of water coming through concrete slab. Water was re-emulsifying asphaltic mastic adhesive, causing it to come to surface with water. Salts in concrete and ground water aid this action

IN RECREATION ROOM, plywood cover of pipe chase in ceiling either fell or became delaminated due to excessive sweating and dripping from chilled water return line. Poor choice of insulation was blamed, but real cause was high dewpoint and depressed dry bulb temperatures



SWEATING PROBLEMS can be doubly severe if both large amount of moisture in air and low surface temperature exist—as in tightly enclosed, heavy concentration of cold lines, shown above

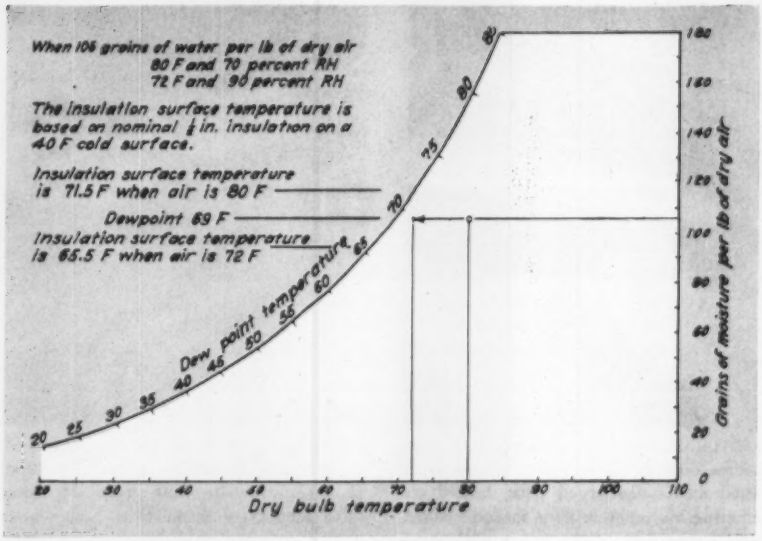


HOSPITAL'S AIR CONDITIONING system has no provision for admitting outdoor air. With very little air moving through space surrounding units, air became cool and cold surfaces started to sweat. Movement of air was reduced by air filter being built in contact with drip pan and of such construction that it could not be replaced nor cleaned

even higher than was measured at the location before the installation was made, and/or the insulation surface temperature is lower than would be expected from either past experience or calculations.

Before discussing these trouble spots, it might be well to take a quick review of the principles of moisture condensation. As we all know, surfaces will sweat when the dewpoint of the air in contact with the surface in question is higher than the temperature of this surface.

Fig. 1 is a simplified psychrometric chart showing what happens when water is added to a sample of air. If the air originally contained 106 grains of water per lb of dry air it would have a dewpoint of 69 F. If water vapor is added to the air until it contains 126 grains of water per lb of dry air, the dewpoint will rise to 73.8 F. If a 40 F chilled water line is insulated with ½ in. insulation which has a thermal conductivity of 0.28 and the air temperature is 80 F, then the surface temperature of the insulation will be approximately 71.5 F. Examination of Fig. 1 on which these values have been plotted reveals that the line in question will remain dry in the original air but will sweat badly in the air to which water vapor was added.


When 106 grains of water per lb of dry air
80 F and 70 percent RH
72 F and 90 percent RH
The insulation surface temperature is based on nominal ½ in. insulation on a 40 F cold surface.
Insulation surface temperature is 71.5 F when air is 80 F
Dewpoint 69 F
Insulation surface temperature is 65.5 F when air is 72 F
Dew point temperature
Dry bulb temperature
Grains of moisture per lb of dry air

2 SECOND REASON for unexpected failure of insulation to prevent condensation shown here. Plotted are conditions that exist when absolute humidity of air remains constant, but air temperature is lowered. Again, effect is illustrated for insulated 40 F chilled water line

Moisture Has Hidden Sources

Water vapor can come from many sources that do not show on building plans or from casual examination of a job. In most of the buildings studied, the greatest percentage of the airborne moisture came from the ground. The same finding was made in several other building research studies, many of which were conducted by universities.

This water might come from the uncovered ground in a crawl space or through the concrete floor and walls of a basement. Large amounts of water vapor might also come from poorly designed or installed air conditioning equipment — condensate drip pans that do not drain, coil systems that cool the air but do not dehumidify it, cooling towers improperly located or exhausted.

Evidence of these conditions was found in a number of the installations studied in the research project. In the hospital, the evaporation of water from the bare moist ground and condensate water draining into pits cause a high dewpoint. In this case the sweating was causing no actual damage but did create a bad odor.

A 6 in. diam pipe in a crawl space under one of the motels studied drains a spring that is located under the poured concrete slab. The spring is so active at times that the concrete slab is chilled by the running water and condensation forms on the floor above. A small stream runs through another crawl space under the same motel. The floor above this area consisted of wall to wall carpeting directly on the subfloor. The amount of moisture that comes through the floor is enough to cause mildew in the carpet and sweating on the air conditioning equipment.

All of the refrigeration equipment in the motel's equipment room, including chilled water and domestic water lines, was sweating when examined. The boiler and other iron surfaces were rusting and there was the feeling of great dampness. It was discovered that the air for the evaporative condenser was pulled from the laundry and discharged through a tunnel area behind a wall. The saturated air from the condenser was discharged through the large hole in the wall. This large volume of discharged air had temperatures as high as 92 F and a relative humidity of 98 percent.

This condition was also causing trouble in adjacent areas. A small hallway connects two rest rooms located directly above the tunnel. The floor of the hall is wood and there were several holes through it where pipes and conduit enter. The hot, humid air from the tunnel blows through these holes and causes a high dewpoint and, therefore, condensation on the cold lines and flush tank of the toilets. To correct this problem in the rest room, hall, boiler room, and laundry it was only necessary to cut a hole through the foundation to provide an outside exhaust and then seal all of the holes to the tunnel area. In addition to drying up the air in the areas in question, this change made a great difference in the operating economy of the water chiller as the evaporative condenser was now receiving lower temperature dry air.

In the same motel, ground water caused dampness in a basement storeroom and water stains on the walls of a basement recreation room. Efflorescence left by evaporation in the

recreation room pushed tile from the floor. The salts had grown as much as 2 in. above floor level.

Another recreation room floor, newer than the other, showed signs of ground water coming through the concrete slab. This water was re-emulsifying the asphaltic mastic adhesive and causing it to come to the surface with the water.

This ground water can also cause a great deal of trouble in the form of sweating on an air conditioning system. In the large recreation room the plywood cover of the pipe chase that runs the length of the room had fallen off in spots.

The air conditioning system had been in operation only a short time before water started dripping through the ceiling. Soon after, the ceiling started to fall. When this happened, the contractor who installed the job called in the wholesaler from whom the original insulation was bought. He in turn called in an insulation salesman who said the trouble was inadequate insulation of poor quality and that it should be reinsulated with a flexible closed cell insulation.

In the original setup, in addition to the condensation from the pipes, the floor also sweated the length of the room. Investigation disclosed that the return line for the chilled water was cast in the floor slab. The return water cooled a large area of the floor and caused it to sweat. This line had to be relocated and the only place to put it was in the pipe chase in the ceiling.

After re-installing the piping and insulation, the air conditioning system resumed operation and there was again trouble from sweating. It was then decided to have a research study made to determine the cause of the problem and to find a solution.

Another Reason for Failure

Up until now, this discussion has dealt with the effect of sources of moisture upon buildings. The study now turns to the effect that lowering of the air temperature has on the insulation surface temperature.

Fig. 2 is a psychrometric chart to illustrate the second reason for the unexpected failure of insulation to prevent sweating. On this chart have been plotted the conditions that exist when the absolute humidity of the air remains constant but the temperature is lowered. If the air contains 106 grains of water per lb of dry air, the dewpoint will be the same as in Fig. 1, or 69 F. If the air temperature is 80 F, as it was in Fig. 1, it is known that ½ in. insulation on a 40 F chilled water line will have a surface temperature of 71.5 F and a relative humidity of 70 percent. If the temperature of this air drops to 72 F, then the insulation surface temperature will fall to approximately 65.5 F.

The chart shows that the insulation will remain dry while the air temperature is 80 F, because the surface temperature will be above the dewpoint. But when the air temperature drops to 72 F, the insulation will be wet because its surface is now colder than the dewpoint. At this lower temperature the humidity will be 90 percent. The change in relative humidity, in this case, is not the controlling factor as far as sweating is concerned. The sweating is controlled by the change in air temperature and its effect upon the insulation surface temperature.

The rise and fall of temperature due to normal weather changes is usually accompanied by a change in dewpoint, with the result that the conditions which cause sweating of the type being discussed here do not exist. It is the situation where air in a building is cooled in such a way that the dewpoint does not change that causes the trouble. Such conditions can be caused by cold surfaces in a confined pipe chase or suspended ceiling area. The cold lines themselves can cause this cooling if many of them are located in a small area with little or no influx of heat.

Some Problems Doubly Severe

The study showed that in some cases sweating problems were doubly severe because of both the large amount of moisture available in the air together with a low surface temperature. A number of trouble spots caused by depressed dry bulb (air chilling) were discovered.

For instance, above the ceiling of the motel recreation room is located a heavy concentration of pipes. This is a small area that is surrounded by poor conductors of heat. A situation was created where the air temperature was depressed by as much as 8 F deg from ambient. The temperature measurement was made with the ceiling in place.

Another problem existed in one of the motel guest rooms. When the chilled water lines were run there was not enough room left for insulation. The pipe was merely covered with tape and painted over. This surface sweats and the water runs down the baseboard and stains the carpet.

Similar problems were uncovered in the office space at a cold storage warehouse. Water stains were caused by sweating from cold lines above its suspended ceiling. The air above the ceiling was found to be much cooler than the room air below and, in addition, the dewpoint was high. The situation was caused because one of the walls was common to a cold storage room. Its cold surface was chilling the air without lowering the dewpoint. The chilled air prevented the insulation surfaces from warming, thereby causing condensation.

To help correct this situation it was suggested that grilles be placed about every 10 ft under the cold pipes and that a large grille be opened in the ceiling of a warm dry area. All the other openings into this suspended ceiling area should then be closed. The warm air would rise through the large grille, circulate through the area, and spill out under the cold lines. This would help keep the area dry and the insulation surface warm. If there is trouble after this treatment, insulation can be placed on the freezer wall.

Drip Pans Block Air Filters

As mentioned, another study was made at a small hospital. The air conditioning system serving this structure presented many problems.

Ordinary commercial projected steel windows are used and these permit large amounts of air leakage. As it is, the air conditioning system is doing such a poor job that the occupants of the rooms open the windows — even while the system is operating at full capacity. There has been no provision for outdoor air introduction into the building, although this would seem to be a must. In addition to no outdoor air there is very little air moving through the conditioning units.

The access panel of one of the room units was removed to determine why there was no air movement. It was found that the air filters were built into the panels in such a way that they could not be removed. After a season's use they were so full of lint and dust that it was almost impossible for air to pass through them. Many of the filters were so located that a large percentage of their areas was blocked by the drip pans.

With little or no air moving through the space surrounding the units, the space became very cool and cold surfaces started to sweat. Many of the surfaces of the units have little or no insulation and as soon as there is no air movement the heat is conducted away fast enough to chill the units.

A small piece of channel iron was found placed near the drip pan drain. Apparently it was placed there to keep the pan from draining, perhaps because there was no place for the water to go. This pan of water and that water which ran over its sides evaporated into the ceiling area and caused a very high dewpoint at a relatively low temperature. In addition to the problems caused by this water it was found that chilled water lines in the space were not insulated and were not over the drip pan.

The piping contractor came in after the insulation had been applied and removed some of the materials so that he could install an automatic air bleed. When this was finished, the insulation was left off. The automatic air bleed also added to the moisture problem because it would leak and spray the area. The air release device should have been drained into the drip pan and the drip pan altered so that it drained into a sewer.

The air conditioning units in the hospital rooms were located over the closets with the air intakes from the closets. There were no grilles nor other air passages through the closet doors, so even if the filters had not been plugged tight there still would not have been enough air circulating through the conditioners unless the doors were left open.

To solve the problem at this hospital the following suggestions were made:

1) Provide adequate air by filtering and dehumidifying outside air and discharging it into the area above the suspended hall ceiling. Small openings could then be cut between this area and the supply side of each room conditioner.

2) Make sure all drip pans are large enough and that they drain well either outside or into a drain. Provide enough insulation on the outside of the pans to keep them from sweating.

3) Check all lines and cold surfaces and make sure they are either insulated or drip into the pans.

4) Drain off all air vents.

5) Rebuild and enlarge all air filters so that they permit adequate air movement. Set up a maintenance program to change the filters.

6) Remove 2 to 3 in. from the bottom of all closet doors to permit the free intake of air.

7) Rewire fan switches to prevent their being turned off completely and modulate the chilled water temperature in the whole system depending upon the outside temperature or overall load. This will help meet the requirements for air circulation, low humidities, more constant temperature, and adequate outdoor air.

8) Seal all windows to prevent their being opened except in an emergency.

An Ounce of Prevention . . .

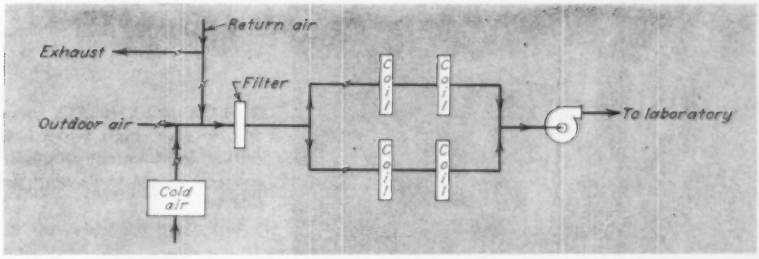
Of course, the best way to combat unexpected sweating is to take every step possible to prevent trouble spots from occurring in the first place. To help avoid trouble, the following suggestions should prove helpful:

If air conditioning is to be installed in a building where vapor barriers were not used, it would be best to examine the basement area or crawl spaces for signs of excessive moisture. When doing this, remember that when the building becomes air conditioned there will probably be a greater influx of water because of the higher vapor pressure difference. If there are signs of dampness extra precautions should be taken in the choice of equipment, its installation and insulation. Be careful of locations where large quantities of moisture are introduced by production operations and processes. Such locations as laundries, dry cleaners, dairies, and canneries are sometimes problems.

All low temperature insulation surfaces must be kept warm if there is to be no sweating. Therefore do everything possible to keep the surface of the insulation from becoming chilled. This can be done by keeping the cold lines spread out and not grouped in one small area, by being careful not to have other cold surfaces too near the lines, and by providing for the circulation of air over the lines. If there are no ways of avoiding these possible trouble spots, then heavier insulation should be used.

When insulating a system be sure that all of the cold surfaces that are not over drip pans are well insulated. Remember that lines such as drains, vents, and high temperature hookups that are connected to the cold lines will get cold by conduction even though there is no chilled water flowing through them. Do everything possible to keep the coils and drip pans drained.

When designing or sizing air conditioning equipment it should be remembered that the same troubles that cause sweating on cold lines and equipment also cause an additional load on the refrigeration equipment. If a good job of air conditioning is to be done, all of the excess moisture introduced into the building will have to be removed on the coils. ⊣



1 DUCT SYSTEM fan, coil arrangement shown here schematically. Duct system was designed for 2220 cfm air flow rate, based on 5 tons of cooling capacity at 25 F deg temperature difference. Varying amounts of outdoor and recirculated air may be selected

Panel Heating, Cooling System Simulates Variety of Load Conditions

. . . for testing electric, electronic control performance

BY W. G. YOUNG
Manager, Product Engineering
Automatic Controls Div.
Barber-Colman Co.

as told to Heating, Piping & Air Conditioning

To PROVIDE simulated load conditions for testing electric and electronic control performance, a panel heating and cooling system is used in the new laboratory of Barber-Colman Co., Rockford, Ill.

The need for this new laboratory was determined when it was decided that facilities for testing all types of controls under a wide variety of loads for both heating and cooling were desired. To test these controls it would be necessary to provide mechanical means for varying the loads that would be experienced in actual installations under changing weather conditions.

Therefore the systems that would impose these loads under test had to be flexible. Another objective was to make it possible to test the controls in conjunction with all types of heating and air conditioning equipment used in large building applications.

The space available within the plant for this laboratory was 20 × 40 × 8 ft.

It was decided to install a panel system in three walls and in the ceiling.

Panels Contact Pipe Directly

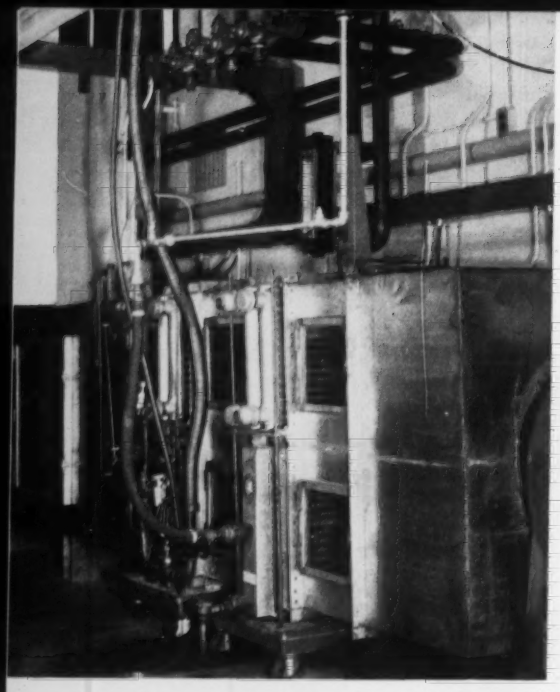
The panel system is served by ¾ in. pipe coils on 1 ft centers. Perforated panels are in direct contact with the pipe and provide the transfer surface when either chilled or hot water circulates through the pipe coils.

With 40 F water passing through the pipe coils, the approximate cooling removal rate was assumed to be 36 Btu per sq ft per hr. This was based on a room air temperature of 75 F. The area of these panels is 1680 sq ft, so the maximum load that may be imposed for simulating winter conditions is 1680 × 36 = 60,000 Btu per hr.

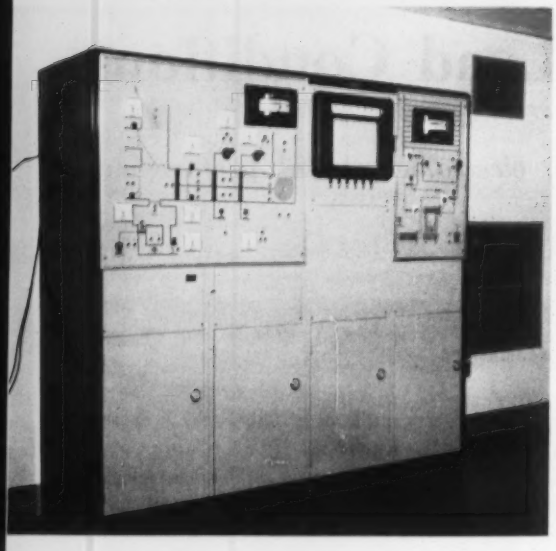
A 5 ton water chiller was selected to deliver this load. It is equipped with a back pressure regulator set at 35 psi which will prevent freeze-up even though no water is flowing through the chiller. This has proved to be very effective.

The pump selected for circulating the chilled or hot water through the coils provides a flow rate of 15 gpm against a head of 85 ft. The unusually high resistance is due to the large number of hand valves, flow meters, and other instrumentation necessary for such a laboratory application.

Condensation on the panel surfaces is recognized, but is not a real problem in this type of application as it occurs only occasionally in extreme summer weather. In this case, hot water is circulated through the coils.



2 FOR FLEXIBILITY necessary to meet high pump head, chiller is mounted on casters, connections are made with flexible hose



3 CENTRAL CONTROL PANEL enables one operator to maintain accurate, constant records and observe all temperature conditions in any area of lab

During the winter, cold water is passed through the coils when the relative humidity is low.

Design Unique Duct System

To study the control performance of all types and combinations of central fan systems, a unique duct distribution system was designed to duplicate any field condition.

For example, warm air can be supplied through the duct system when the walls and ceiling impose a simulated winter load condition by circulating chilled water through the pipe coils. Likewise, the provision for the reverse conditions had to be incorporated into these systems.

The duct distribution system was designed for an air flow rate of 2220 cfm, based on 5 tons of cooling capacity at a temperature difference of 25 F deg. This air flow rate corresponds to one air change in the lab every 3 min.

The coils in the duct system may be interchanged without difficulty. Fig. 1 is a schematic diagram of this duct system and fan and coil arrangement. Varying amounts of outdoor and recirculated air may be selected.

A separate direct expansion system cools air to zero F. This air may be used as a substitute for outdoor air, if desired.

Loads on the controls are created by the panel system only. Ceiling outlets in the lab admit air from the central fan system which may provide various temperature conditions to suit test requirements.

This is but one means incorporated in the lab for testing controls. Some of the systems and equipment that will be tested for various control conditions are: equipment components (such as coils, dampers, etc.), many types and combinations of central fan systems, and unitary systems including direct radiation, unit ventilators, fan-coil units, induction units, etc.

Control from Central Point

The entire lab and its equipment are controlled from a control center in the lab, shown in Fig. 3. This enables one operator to maintain accurate and constant records and observe all temperature conditions existing in any area of the laboratory. This control center is equipped with lights and switches to indicate and simulate valves, pumps, fans, compressors, coils, etc., in both the panel system and central fan system.

The smaller panel at the right controls the water temperature flowing through the walls and ceiling. Therefore exact temperature observations of water inlet and outlet temperatures in any or all of the pipe coils can be made. By adjusting the specific dials, it is possible to change the wall and ceiling temperatures.

The larger panel on the left illustrates on the schematic diagram the exact conditions existing in the air flow system and permits the operator to position and control dampers in both the hot and cold ducts to meet any specific condition.

An analog computer has been incorporated as a part of the laboratory to check test results. Exact analogies of the system under test can be fed into the computer with the resultant answer being available long before the test is completed. Actual results are then compared with computer results, with each acting as a good check on the other. ≠

INDUSTRIAL VENTILATION:

How Are Built-up Systems Designed?

Some of the advantages of the built-up industrial building ventilation system are flexibility, controllability, and unlimited capacity. To reap these benefits the engineer must call on his keen judgment and practical experience when designing these systems. Considerable care must be given to selecting proper equipment locations, choosing the right inlet types and applying them correctly, and designing system casings to be sturdily built and with all compartments accessible.

BY JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.

PREVIOUS ARTICLES in the April, June, and July issues have described the need for industrial building ventilation, the various types of systems and their applications, and the principal types of "package type" equipment and their applications. It is the purpose of this article to describe the advantages of the built-up system and the features which the author believes should be incorporated in such design.

The design of built-up systems requires considerable judgment, experience, and design work. Therefore it would be expected that many engineers and contractors contemplating the installation of industrial ventilation equipment would turn to ready built, package type equipment as an easy way out. Such equipment has sometimes been oversold beyond the point of its proper applications, as was indicated in the article in the July issue.

There can be no question but that the built-up type of system is the most suitable for the essential industrial makeup, ventilation, and air conditioning systems. A built-up installation would include the factory built prefabricated and knockdown type of equipment. Above about 40,000 cfm there is no alternative because few package type air handling units are available above that capacity. Actually, package units are seldom used above 20,000 or 30,000 cfm because of their size. But the built-up systems are applicable to all supply air requirements in industrial areas—even the small systems—when reliability and continuous, essential service are required.

The author is a member of the technical advisory committee on industrial environment of the American Society of Heating and Air-Conditioning Engineers. He has written several articles for Heating, Piping & Air Conditioning on the various aspects of operation and maintenance of heating, ventilating, and air conditioning equipment and systems in industrial plants.

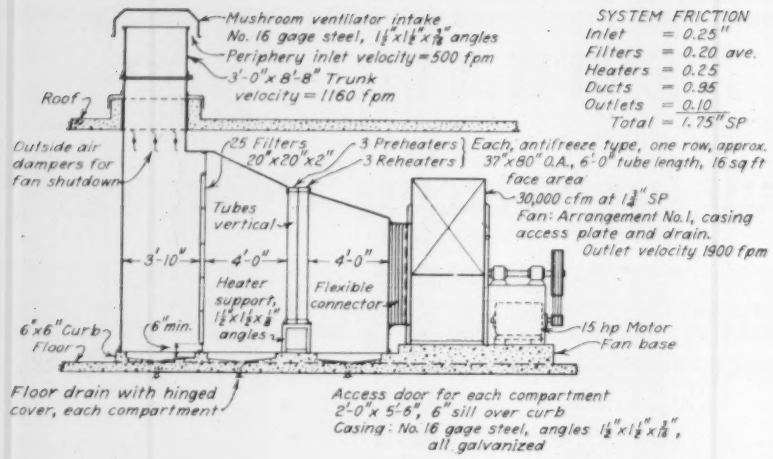
What Are Advantages of Built-up Systems?

These systems have many advantages, of which the following are of importance:

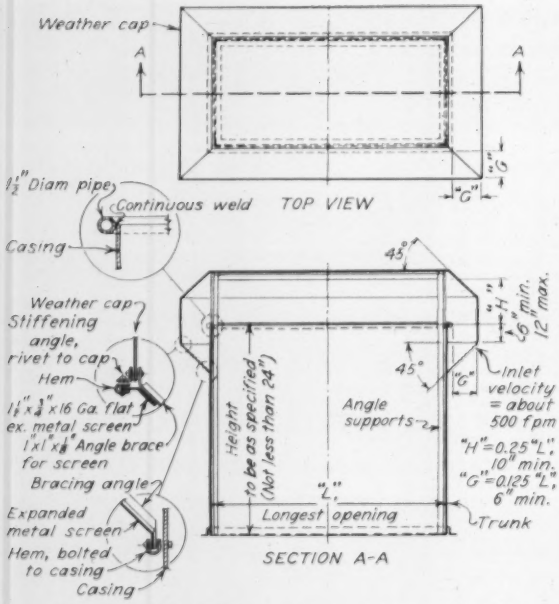
1) They are reliable, flexible, and controllable systems because each integral piece of equipment can be designed and selected, within practical limits, for efficiency and the best operating conditions for the job to be done. While they cost more initially than other system types and take up more space, these factors are offset by the advantages provided and the ease and low cost with which they may be operated, inspected, and maintained. There has been a growing realization that it costs very little more to design or maintain a 100,000 or 200,000 cfm system than it does for a 20,000 cfm system. And the initial and operating (power) costs tend to be considerably less per cfm for the larger systems. Consequently, there has been a marked trend toward a few large systems in lieu of many smaller systems. System sizes of 100,000 to 200,000 cfm are quite common. Capacities are limited only by the practical considerations of fan capacity and available space.

2) The systems may be designed for any variation of temperature or humidity control by means of air heaters, cooling coils, sprays, capillary cells, or damper arrangements. The heating, cooling, and humidity requirements may be met by means of steam, hot or chilled water, sorbents, or other mediums as desired.

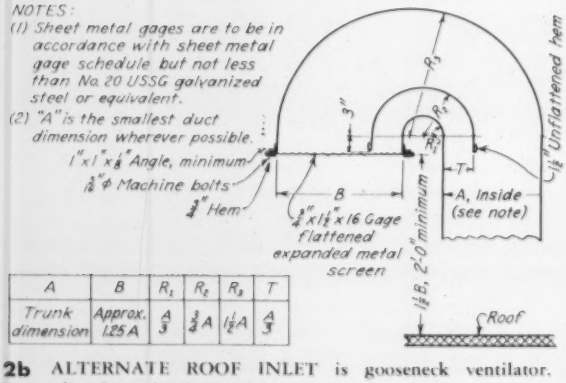
3) System pressure is not a limitation. Therefore duct distribution systems which will do a better job in less space are tenable. In many industrial areas the space may not be available for large ducts. Consequently, duct veloci-



1 CASING for built-up industrial supply air system should be well constructed, should permit hosing down for cleaning, and should provide easy access to components for maintenance



2a BEST SYSTEM INLET would be roof inlet of mushroom type. This type of inlet and such location are favorable for reducing wind effect and system short-circuiting


NOTES:
(1) Sheet metal gages are to be in accordance with sheet metal gage schedule but not less than No. 20 USSG galvanized steel or equivalent.
(2) "A" is the smallest duct dimension wherever possible.
1"x1"x⅛" Angle, minimum
½"ϕ Machine bolts
¾" Hem
¾"x1½"x16 Gage flattened expanded metal screen
3"
B
A, Inside (see note)
T
1½" Unflattened hem
1½R, 2'-0" minimum
Roof

A	B	R_1	R_2	R_3	T
Trunk dimension	Approx. 1.25 A	$\frac{A}{3}$	$\frac{1}{6}A$	$1\frac{1}{2}A$	$\frac{A}{3}$

2b ALTERNATE ROOF INLET is gooseneck ventilator. For reduced wind effect and increased weather protection, 180 deg gooseneck (shown above) should be used

ties of 3000 to 6000 fpm are not uncommon. Where power costs are low it might take 10 years or more for the power savings of a low velocity, large duct system to offset the lower initial costs of a small duct, high velocity system. High velocity systems are usually easier to balance than their low velocity counterparts. However, *close* balance is seldom required for industrial applications.

These systems usually operate at static pressures exceeding 1 in. water gage. As a result, they are little affected by wind conditions (changing building pressures resulting from wind). Where operated with equally well designed exhaust systems these systems provide stable, uniformly balanced conditions within the plant areas.

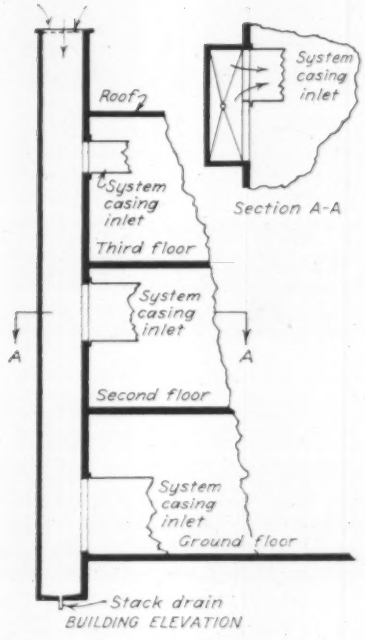
4) Excellent control can be provided because of the ample space available and the better arrangements which are possible for dampers, heaters, fans, and ducts. These in turn reduce or eliminate the stratification problems and permit better locations for the thermostats. Proper equipment sizing for the specific job also eliminates overcapacity—an important factor in good control.

5) Any type of filtering may be provided. Where extremely clean conditions are essential it is easy to make these systems tight. The filter sections may be so located as to be readily accessible for maintenance. Space may be provided for prefiltering and afterfiltering where this may be required.

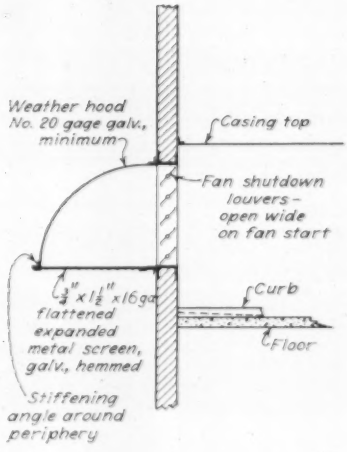
Difficulty Is Lack of Design Information

The main difficulty with built-up systems seems to be a lack of design information as to what is required and uncertainty on the part of the design engineer in developing the required details. One friend who has been in the ventilation field for many years recently remarked that he thought that many engineers had forgotten *how* to design—thus the tendency to let the equipment people do this work for them with package equipment which may be only partially suitable or totally unsuitable.

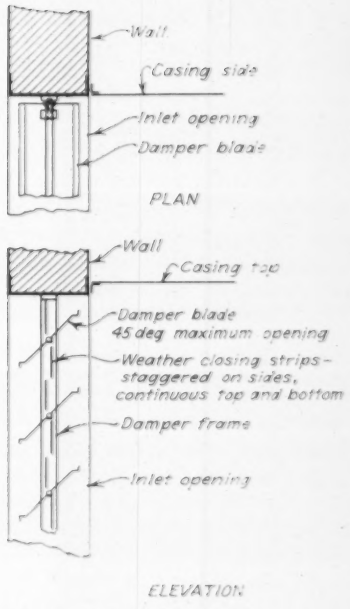
It should not be expected that all engineers will agree on all details of design. Frequently there are several good ways of putting this equipment together. This article cannot hope to cover all of the acceptable methods. Details on controls* and piping for freeze protection, duct



2c STACK OR PILASTER inlet is another recommended type. Unit provides good wind and weather protection and permits addition of capacity or new systems without new penetrations of outside wall


Weather hood No. 20 gage galv., minimum
Casing top
Fan shutdown louvers – open wide on fan start
Curb
Floor
⅜" x 1½" x 16ga flattened expanded metal screen, galv., hemmed
Stiffening angle around periphery

2d CANOPY TYPE of wall inlet is rated second choice. Unit is good weatherwise but may be susceptible to wind conditions. Negative pressure may cause fume pickup when unit is located on lee side of building



2e THIRD CHOICE is louvered wall inlet. This is most vulnerable to wind effect and weather conditions. Damper can be set to open at 45 deg maximum to perform weather protection and permit omission of fixed louvers

distribution and outlets, systems designed for hot water and gas heat, and the design of special systems such as for evaporative cooling will be covered in future articles. The following comments apply particularly to steam heated supply air or make-up systems.

Rate Various Locations for Systems

The best location for supply systems is in a fan room at floor level where all equipment may be readily inspected, maintained, and operated. Where possible, the largest number of systems practical should be located in a single fan room. Adequate space should be provided around each system for the maintenance and removal of filters, heaters, motors, and fan impellers.

The second choice would be the building roof, preferably in a penthouse, although outdoor units are tenable. The outdoor units present difficult insulation problems. The roof must be readily and safely accessible to make this location acceptable. Where a number of systems or penthouses are located on a roof, the maintenance of all will be improved. It is usually a good idea to provide walkways across built-up roofs.

The third choice would be in the truss space. In many cases this may be necessary, but because of the awkward and tiresome climb of 15 to 30 ft it is difficult to maintain such systems. Conditions are improved, as previously noted, where a considerable amount of equipment is grouped on an equipment platform. Further improvement will be realized where it is possible to provide stairs (in lieu of ladders) to the platforms, or where it is possible to provide catwalks in the truss space to connect the various systems.

It should be kept in mind that the systems or inlets should be located so as to minimize the possibility of short circuiting hot air or fumes exhausted from buildings.

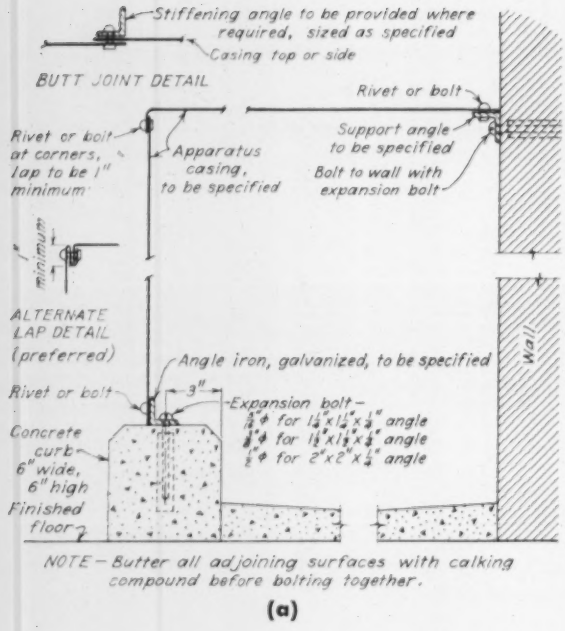
For system inlets there again is a choice of several types and locations. First choice would be a roof inlet of the mushroom type, as shown in Fig. 2a. This type of inlet and location are preferable from the standpoint of reducing wind effect and fume short-circuiting.

An alternate roof inlet is provided by the gooseneck ventilator. It is my firm opinion however that, for reduced wind effect and increased weather protection, the 180 deg type of gooseneck should be used, illustrated in Fig. 2b.

Another type of roof inlet which has many advantages is the stack or pilaster type, Fig. 2c. This inlet has been used in a number of industrial applications. It can provide good wind, weather, and fume protection and has the added advantage of permitting the addition of capacity or new systems without the need to provide new penetrations in the outside wall. This is important for multi-storied industrial buildings, and particularly where good appearance is desirable.

Second choice for inlets would be a canopy type wall inlet, shown in Fig. 2d. This is a very good inlet weather-

*See also "Why Steam Coils Freeze," by H. W. Alyea, in the April and May issues.



3 SYSTEM CASING for floor or roof location should have watertight curb "pan" illustrated by (a), with drain arrangement similar to (b). Note that cover as well as strainer is shown for drain assembly and that deep trap is indicated. Casing should permit hosing down complete interior for cleaning

wise but it may be affected by wind conditions somewhat more than the roof inlets. If located on the lee side of a building in a negative pressure zone, fumes from outlets on the building roof may be drawn down into the inlet. No inlet, however, is completely immune to fume pickup.

The third choice would be the usual louvered type of wall inlet, illustrated in Fig. 2e. This is the most vulnerable to wind effect and weather conditions including rain, snow, dust, and airborne vegetable matter. If this type is used it has been my experience that it is not necessary to have both a stationary louver and a system outside air shutoff damper. The latter can be set to open a maximum of 45 deg and will provide weather protection.

Locate Inlets High, to Minimize Intake

In all cases the inlets should be carefully located and should be high enough to minimize fume and dirt intake. The use of below grade areaway intakes should never be condoned except as a last resort. They certainly cannot be justified by architectural or esthetic requirements. Such inlets are catch-alls for leaves, airborne vegetation, dirt, and snow which cause no end of maintenance trouble. Many city codes prohibit the use of such inlets.

There is a great variety of opinion on the use of screening over the inlets. Insect screens (1/16 in. spaces) should never be used because of the possibility of plugging. Most designers agree that ½ in. mesh, No. 16 gage galvanized steel (or aluminum in some cases) is the smallest that should ever be used. In areas of heavy, oily dirt load I have seen such screens solidly plugged. For this reason it has been my practice to require ¾ in. × 1½ in. × 16 gage flattened expanded metal, either aluminum or steel as applicable. For goosenecks or other inlets which are not readily accessible for maintenance on both sides, the screens should be hemmed and fastened on with the fewest bolts possible (12 in. spacing is usually ample) so that they can be removed for maintenance.

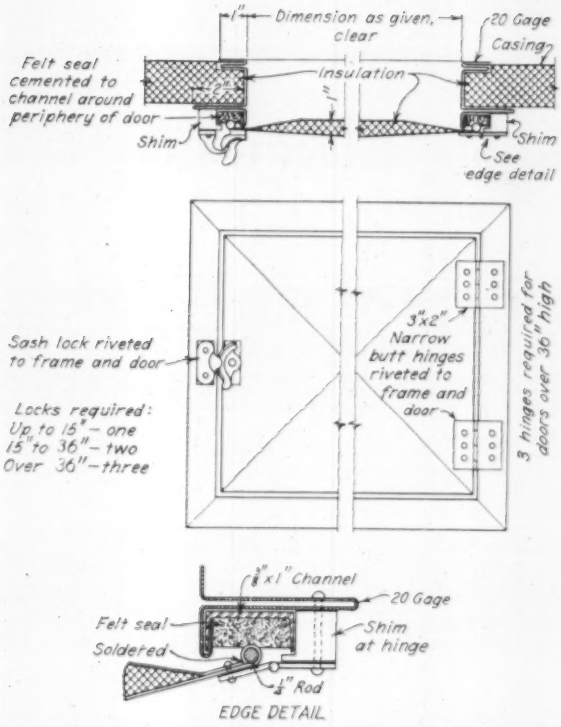
Some thoughts linger from my long marine engineering training, for it is my feeling that system casings should not only be well built but that all compartments should be readily accessible. I also feel that it should be possible to hose down the complete interior for cleaning. Consequently, whether built on the floor, roof, or truss, the bottom should be a watertight drain pan, provided with drains.

For floor or roof location a curb "pan" should be provided, as shown in Fig. 3a, with a drain arrangement similar to Fig. 3b. It should be noted that a cover as well as strainer plate is shown for the drain assembly and that a deep trap is indicated. These will reduce water evaporation and thus maintain the seal, which will prevent air from bypassing around the filter section.

The cover is a hard choice, but I believe it is the better of two evils. Casual water (snow and rain spray) will drain through the covers because they are not completely tight. The cover will keep the dirt out of the drain and prevent the trap from clogging. Open drains are particularly vulnerable during construction and never get properly cleaned out.

The casing sides and top should be of sheet metal, angle reinforced. The following schedule is suggested:

		Angle stiffeners	
System capacity, cfm	Sheet metal gage	Size, in.	Maximum space, centers, ft
To 5000	18	1¼ × 1¼ × ⅛	5
5000 to 10,000	16	1½ × 1½ × ⅛	5
10,000 to 50,000	16	1½ × 1½ × ⅛	5
50,000 to 100,000	14	1½ × 1½ × ¼	5
Over 100,000	14	2 × 2 × ¼	5



3c WELL CONSTRUCTED access door should be provided for each casing compartment. Usually, size 24 in. wide × 5 ft, 6 in. high with 12 in. sill is adequate. Minimum door size is 18 × 18 in. Latch to permit opening from inside is desirable

Ordinarily the equipment (filters and heaters) will provide adequate stiffening except for the fan inlet section. For large casings, longitudinal stiffeners should be provided on 4 ft centers at least for the fan inlet to provide additional stiffening. Additional stiffening is usually required at the access door frames for good rigidity. Stiffeners should be located on the outside and can be either riveted or welded to the sheets. Edge longitudinal seams should be lapped and riveted, or welded. I prefer not to use standing seams of any type for either the transverse or longitudinal seams, although they are permitted on the small systems (around 5000 cfm).

All joints with the wall, curbing, filters, and heaters should be buttered with caulking compound before bolting up, in order to make the casing tight. All piping should be kept out of the casing compartments insofar as possible and the penetrations necessary should be sealed with closing plates. The same would apply to conduit and lighting penetrations.

Well constructed access doors should be provided for each compartment. Usually, a door 24 in. wide × 5 ft, 6 in. high with 12 in. sill (6 in. over the curb) is adequate in most applications. The height must be reduced, of course, for small systems. The doors should not be less than 24 × 24 in. if it is possible to avoid it, and 18 × 18 in. should be the minimum.

It is very desirable that the door latch permit opening from the inside. The usual sash locks are handy, inexpensive latches. But they have been known to drop into the locked position unaided. A detail of one type of door is shown in Fig. 3c.

Except for very small systems, a light of the vaporproof type should be provided for each compartment.

Ordinarily the system casings should be made of steel, in which case the sheets, angles, and other members should be galvanized insofar as possible. However, in cases where considerable humidity is added by water sprays, atomizers, or steam, and particularly in cases where there is a need for a very clean system, it would be well worthwhile to use aluminum. The small extra cost would be more than repaid in reduced maintenance. In such cases the aluminum should be two gages heavier than the steel and the angles should either be increased in size or flange thickness.

The availability and use of welding are increasing greatly. Wherever practical it should be used for both steel and aluminum for seams and the angle stiffening construction.

36 in. Minimum Space Between Components

Regardless of the size of the system, about the same minimum space is required between the casing components. The desirable minimum is about 36 in. The inlet space ahead of the filters should be adequate to permit maintenance and to permit good air flow to the filters. About 30 in. is the least that should be provided for any system, regardless of size. The distance between the filters and the heaters should be at least 24 in. Where filters are used that are oiled, and the air heaters are too close, the oil will evaporate from the media much more rapidly than with wider spacing.

The distance between the heaters and the fan should be determined by the length which would provide an included transition angle not exceeding 60 deg from the heater face to the fan inlet in either the horizontal or vertical plane. These details are shown in Fig. 1.

It is advisable to provide good working space if good maintenance is desired. By the same token, the compartments should be kept clear. This means that heater piping and traps should be kept outside the casing, except for the actual connected piping.

Future articles on built-up industrial ventilation systems will discuss the proper design and application of outside, return, and bypass dampers, air filters, air heaters, fans, and electrical equipment. ⊣

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Increase Compressed Air Efficiency Through Mechanical Refrigeration

Improved performance and reduced operating and maintenance costs are among the rewards of conditioning "raw" air for compressed air systems. In the July issue the author discussed some of the basic principles in the design of such a system. He continues here, describing dehumidification through mechanical refrigeration as a means to obtain greater efficiencies.

BY FRANK D. ROSS
Mechanical Engineer
Advanced Engineering & Supply Corp.

A LARGE percentage of all troubles experienced in operation of compressed air equipment are caused by moisture in compressed air.

Practical considerations limit the amount of moisture that can be eliminated in the inter and aftercoolers. Further moisture removal requires the use of apparatus designed to introduce a dehumidification effect to bring about the desired degree of dryness. This apparatus should only supplement the aftercooler; it is not intended as a substitute.

One method of dehumidification is by refrigeration.

The amount of moisture air can hold before condensation occurs is in direct proportion to its temperature and in inverse proportion to its pressure. In other words, the hotter the air, the more water it can hold. A change in either pressure or temperature upsets the stabilized condition of saturated air. If the pressure becomes higher while the temperature remains constant, the air loses part of its vapor carrying capacity and condensation occurs. Conversely, if the temperature becomes lower while the pressure remains constant, the vapor carrying capacity is reduced and the vapor condenses to liquid form.

The behavior of water vapor in air is explained by a fundamental law of thermodynamics. Dalton's Law of Partial Pressures states that total pressure exerted by a mixture of perfect gases is equal to the sum of the pressures that each gas would exert if it were present alone.

A mixture of air and saturated water vapor is commonly spoken of as saturated air. This is not correct because air is not saturated. It is only the water vapor that is saturated. The specific humidity of an air-vapor mixture is the weight of moisture mixed with each pound of dry air. For most practical purposes, it may be assumed that air and vapor behave as a perfect gas and that Dalton's law applies.

The water vapor content may be computed by means of Equation 6*. For most compressed air applications, the error introduced by assuming the mixture acts as a perfect gas is generally within the limits of acceptable accuracy for practical consideration.

$$W = 0.622[P/(P - p)] \quad \ldots\ldots\ldots [6]$$

where:

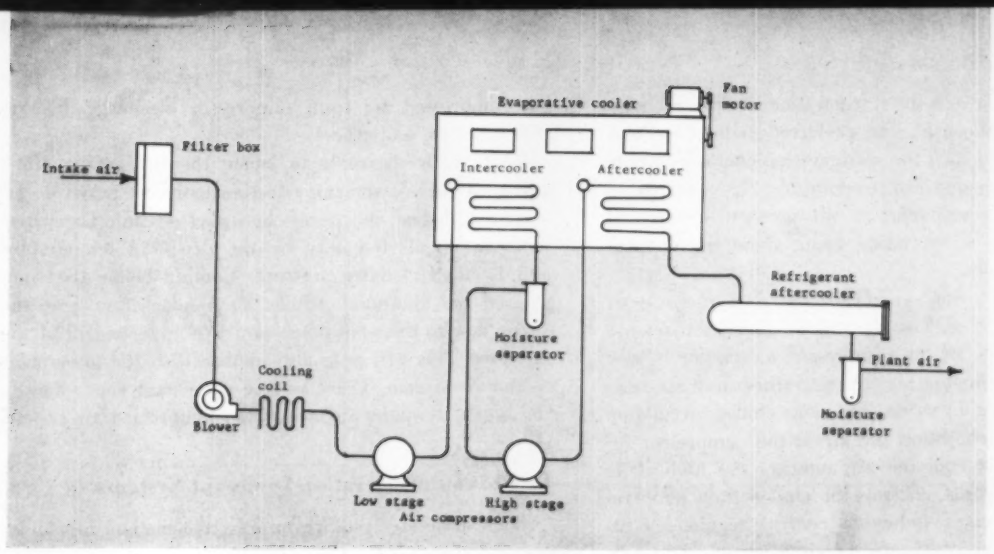
W = lb of moisture per lb. of dry air in mixture
P = partial pressure of water vapor, psia
p = total pressure, psia.

Using this formula, the amount of moisture that can be removed by reduction in compressed air temperature can be readily calculated.

Values of specific humidity at various pressures and temperatures are given in Table 2.

To eliminate the error caused by water vapor not behaving as a perfect gas, the actual steam table values of the specific volume of the vapor at various saturated temperatures may be used. Where large air volumes or

*Equations 1 through 5 were in the July issue.



CONDITIONED COMPRESSED AIR SYSTEM filters intake air and dehumidifies it by cooling before air is compressed. Further moisture is removed between two stages of compression. Oil as well as moisture is separated from air at refrigerant aftercooler before air is delivered to plant

high pressure air is involved, it may be desirable to use the following equation:

$$W = [(53.35)(460 + t)]/[144(P - p_w)V_w] \quad \ldots\ldots\ldots\ldots\ldots\ldots [7]$$

where,

W = lb of moisture per lb of dry air
t = saturated temperature of the vapor, F
P = absolute pressure, psia
p_w = partial pressure of vapor, psia
V_w = specific volume of vapor at saturation temperature, cu ft per lb of vapor.

The combination of increasing pressure and decreasing temperature processes air to low dewpoints. In the plant air system, refrigerating the compressed air results in low "free" air dewpoint temperatures. As the process is one of condensation, moisture as well as oil vapor and other extraneous matter is continuously washed from the air system.

TABLE 2—SPECIFIC HUMIDITY of compressed air at various pressures and temperatures is shown here. (Table 1 was in the July issue)

Saturated temperature, F	Specific humidity of compressed air, lb per lb of dry air — Pressure, psia				
	20	40	60	80	100
120	0.0575	0.0275	0.0181	0.0134	0.0107
110	0.0424	0.0205	0.0135	0.0101	0.0080
100	0.0310	0.0151	0.0100	0.0075	0.0060
90	0.0225	0.0111	0.0073	0.0055	0.0044
80	0.0162	0.0080	0.0053	0.0040	0.0032
70	0.0115	0.0057	0.0038	0.0028	0.0023
60	0.0081	0.0040	0.0027	0.0020	0.0016
50	0.0056	0.0032	0.0019	0.0014	0.0011
40	0.0038	0.0019	0.0013	0.0009	0.0008
35	0.0031	0.0016	0.0010	0.0008	0.0006

For most pneumatic control installations it is practical to increase the receiver pressure to 200 psig or higher. Extremely dry air for pneumatic control may be obtained by cooling it to about 40 F.

In the design of a refrigerant dehumidifier: (1) the air should drop its moisture as completely as possible before entering the system, and (2) provision should be made for drawing off the condensate. The heat exchanger used for chilled water applications makes a most efficient compressed air cooler. The only modifications necessary are drainage openings in baffles for condensation removal. The compressed air — by directing the flow, the amount of turbulence, and the length of contact with cooling surface — should be such that the wet bulb, dry bulb, and dewpoint temperatures tend to coincide. The heavy density of compressed air provides a medium having a relatively high conductivity.

Of special importance, the cooler design should not impose a heavy operating penalty by an excessive air pressure drop. The consensus is that over 1 psi pressure drop may be considered excessive for any individual heat exchanger. The standard compressed air moisture separator, trimmed with a float type of trap, will automatically and continuously drain the condensate.

The refrigerant aftercooler may be of the direct expansion type or may employ chilled water or brine. Generally the air demand flow is not a steady stream but a widely fluctuating one. For the single air compressor installation, a direct expansion chiller has proved to be satisfactory. The chiller is usually installed between the compressor and receiver.

Several methods of control may successfully be used.

The air compressor and the refrigeration compressor may be started simultaneously. The preferred method is for a time delay relay to start the refrigeration compressor first to bring the chiller down to temperature. For compressors equipped with an unloader, an air pressure differential switch across the chiller would bring about the application of refrigeration.

One system offering great flexibility is the use of chilled water or brine. The continuous circulation readily permits installation of the compressed air chiller in any location. Widely fluctuating air quantities and air temperatures are taken in stride. The same chilled circulation system may also condition the air at the compressor intake as well as to cool the air entering the high stage cylinder. A thermostat controls the chilled fluid temperature, and compressor reduction control regulates compressor capacity according to the refrigeration demands.

How Refrigeration Effect Can Be Recovered

A large portion of the refrigeration effect can be recovered and made to perform useful work. There are several ways this can be done.

For the smaller systems, the refrigeration effect may be employed to condense the hot refrigeration discharge gas — in other words, the heat pump cycle of operation. It is generally advisable to install a small supplementary condenser to handle condensing requirements during periods of light load. This arrangement practically eliminates the need of water for condensing purposes.

The refrigeration effect of the leaving air may be utilized by the introduction of the familiar "run around" cycle. Heat exchangers are placed before and after the refrigerant aftercooler, and water is circulated between the two heat exchangers. Heat removed from the cold outlet exchanger by the circulating water is used to precool the air in the upstream side heat exchanger. The amount of heat during reheating is exactly offset by the amount of heat removed from the compressed air during precooling.

The amount of the regenerative effect that can be obtained varies with particular requirements, but the reduction in mechanical refrigeration capacity is most appreciable. For the average installation, the refrigerant aftercooler requirements may be reduced approximately 40 percent.

Many industrial plants may require refrigeration for process work and have a central refrigeration plant in which capacity may be available for conditioning compressed air, and when an evaporative type of inter and aftercooler is used, an additional condensing section may be incorporated for refrigerant condensing.

Objections may be raised as to the decrease in air volume by lowering the air temperature by refrigeration. The large surface of the exposed compressed air mains will quickly bring the air to plant ambient conditions. If temperatures above ambient deemed necessary, reheating of air is a simple process. Among common sources of heat available in an industrial plant are steam, hot water, hot compressed air from compressor discharge, hot refrigerant gas, and others.

While it is desirable to locate the refrigerant aftercooler in the air stream, effective moisture removal can be accomplished outside of the direct stream. The vapor pressure is affected only by the dewpoint temperature and is unaffected by pressure. Cooling below the compressed air dewpoint results in condensation and the vapor flow to this cold point would be independent of the air flow. This principle also applies with the aftercooler in the air stream. There will be a constant vapor flow to the lowest dewpoint surface in the compressed air system.

Combine Refrigeration-Desiccant Systems

Some processes require an effective method of obtaining compressed air ultra low in moisture content. At temperatures below freezing, consideration must be given to frost buildup, with the consequent increase in the air pressure drop and the decrease in the heat transfer rate in the refrigeration chiller. For the low dewpoint system it is desirable to remove the great portion of moisture without frost accumulation. This calls for moisture removal in two stages. Examination of Table 2 shows that air at 100 psia and 35 F has a specific humidity of 0.0006 lb per lb of dry air.

The amount of moisture remaining is certainly not appreciable. In a two stage system, the first stage would condense out the moisture continuously. The second stage can be designed to lower the dewpoint to any predetermined level. Due to the low moisture content, frost accumulation would be extremely light. It would be less with increase in pressure, therefore, for low moisture systems the pressure should be maintained at highest practical limits.

Frost accumulation can be eliminated intermittently and at reasonably long intervals. The low temperature coolers can be also furnished in duplicate and a continous defrosting cycle established. For laboratory work, mechanical refrigeration has been used for compressed air at dewpoint temperatures lower than −100 F most satisfactorily.

An excellent method to achieve low dewpoint temperatures is a combination refrigeration-desiccant system. Most of the moisture and oil vapor can be condensed by refrigeration. Also most contaminants would be washed out by the condensate, leaving cool, clean, and relatively dry air for the desiccant system. The moisture absorbing property of a desiccant is inversely proportional to its temperature. The cooler the entering air, the more moisture the sorbent system is capable of absorbing, and the lower the leaving dewpoint. The main plant air could be advantageously dehydrated with mechanical refrigeration, leaving to desiccant dryers in branch mains the processes in which ultra dry air proves useful.

The improvement in volumetric performance with decrease in bhp per unit volume delivered is evident. Conditioning of air to a low dewpoint temperature decreases maintenance costs and insures improved performance. ≠

Tear out along this line

HPAC DATA SHEET

How Much Gas to Heat Water?

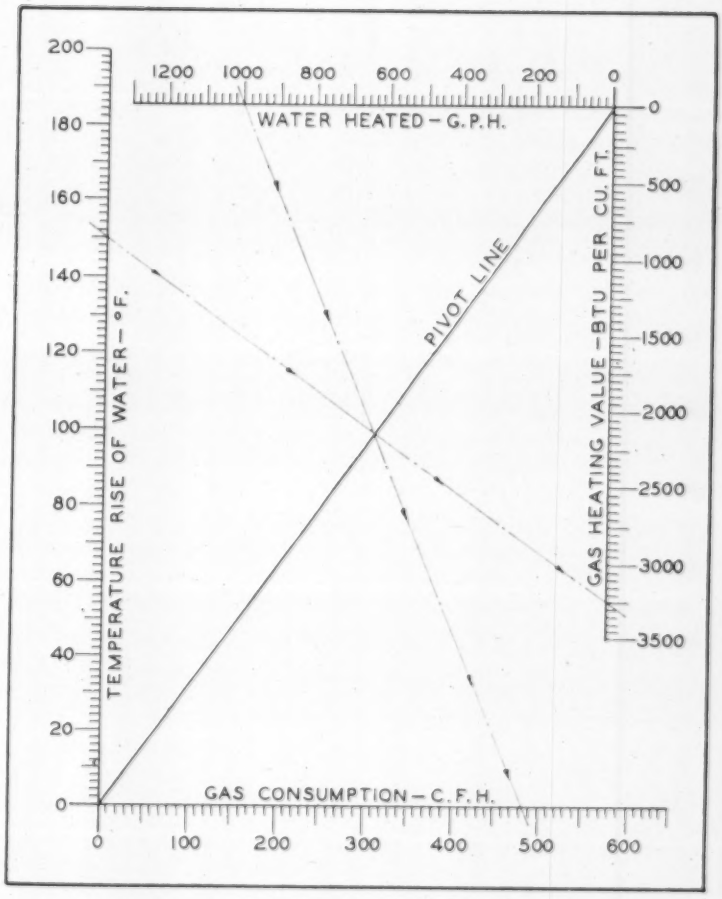
BY MERLIN SAVAGE, JR.
Consulting Engineer

THE accompanying nomogram may be used to determine the quantity of natural, manufactured, or LP gas required for water heating for hotels, restaurants, industrial processes, and other uses (exclusive of the fuel required to take care of piping and standby losses, etc.). All that it is necessary to know to use the chart is the heating value of the gas being used.

This chart is based on a water heater efficiency of 80 percent, a good average value for year 'round operation. To check the gas bill for a user, merely multiply gas consumption by the unit cost and the number of hours of *full load operation.*

If heater efficiency is known to be greater or less than 80 percent, divide the gas consumption from the chart by the ratio of the new efficiency, expressed as a decimal, to 0.80.

Be sure to obtain the correct heating value of the gas before using the chart. Heating values, in Btu per cu ft, for commonly used gases (depending on enrichment, adjuncts, etc.) are as follows: natural, 1000 to 1100; propane, about 2500; butane, about 3400; manufactured and mixed, 530 to 800. For accurate results, consult the local gas company or the utility providing the fuel. ≠



Example: How much gas is needed to raise the temperature of 1000 gph of water from 50 F to 200 F when heating value for butane is 3250 Btu per cu ft?

Solution: The temperature rise of water is 200 F − 50 F = 150 F deg. Enter chart at the left at this temperature rise and draw a straight line through the gas heating value (3250) on the right hand scale. From the top of the chart draw a straight line from 1000 gph through the intersection of the first line where it crosses the sloping *pivot line.* At the bottom scale, read the gas requirement as 482 cfh

The Law and Your Profits

BY WILLIAM HURD HILLYER

Underbidding Bears Bitter Fruit

THE FOLLOWING series of blunders by a piping contractor began with an underestimation and hence his underbidding for a contract job. It hardly seems necessary to stress the importance of estimating costs correctly, yet this case expresses such a need.

B. X. Akt was awarded a contract for the installation of an air conditioning system for a church educational building. He in turn entered into a subcontract with Kly-Mattick for the erection of component piping.

The pertinent provisions of the contract were that the subcontractor furnish all labor and materials and perform all work in strict accordance with the plans and specifications. Performance of work was to be in such manner as to avoid delay in progress of job. His compensation was to be $2,665.17.

The specifications provided that all piping be insulated according to its use.

Kly-Mattick started work in May. Around mid-November, Kly-Mattick's foreman informed B. X. Akt that Kly-Mattick was "through" and that any further work on the job would be done for additional compensation. There was a substantial amount of work yet to be done on the piping installation.

Understandably, B. X. Akt told the subcontractor's foreman that if he and his helpers were "through" they should "pick up their tools and get out."

B. X. Akt thereupon employed another firm to complete the installation of the piping and to finish its insulation. This was done at a cost of $2199.99.

When Kly-Mattick abandoned the job he received $1658.35 on his subcontract but he had performed certain other work not covered by his contract. This was done under an oral agreement called "extra work," for which it was stipulated that the contractor owed the subcontractor $123.22.

Kly-Mattick was sued by B. X. Akt in chancery court to recover for alleged breach of contract. The subcontractor at the same time filed a cross bill to recover for his extra work. There had been a dispute as to whether any materials were used on that work, but the subsequent litigation established that B. X. Akt owed Kly-Mattick $316.70 for materials so used.

Kly-Mattick's answer to the contractor's suit was quite ingenious. He claimed that he was not obligated to do the insulation, because the word "insulation" was not used in the contract itself, even though insulation was required by the specifications to which the contract referred.

The court chancellor did not share this view and gave B. X. Akt a judgment against the subcontractor for $1053.25—this amount being the difference between what B. X. Akt had paid Kly-Mattick plus what he had expended to complete the job and the value of Kly-Mattick's contract plus the monies due him for extra work and materials.

"It is apparent," commented the state supreme court when Kly-Mattick appealed, "that the subcontractor underbid the contract. The central question in this case is whether the insulation of the piping was part of the work to be performed by the subcontractor under the contract."

As the court saw it, the contract very plainly required the subcontractor "to furnish all labor and materials and perform all work for piping in strict accordance with the plans and specifications. Moreover, the actions of the parties subsequent to entering the written contract show that both parties contemplated that the subcontractor was required under the contract to insulate the piping."

Not until the job was nearly completed did the subcontractor declare that he was not required to insulate. This was despite the fact that he had already spent more than $2000 on labor and materials in insulating the piping with no other contract except the written one first referred to.

"It is inconceivable," said the court, "that the subcontractor would have expended all this money if he had not understood that it was included in the contract."

The court affirmed the chancellor's decision and left the hapless Kly-Mattick saddled with a thousand dollar judgment.

In this case the piping contractor committed a succession of errors and mistakes of judgment—all expensive—stemming from his underbidding and his failure to chart a clear course of action based on unequivocal written agreements. ∓

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that laws vary in different states.

HEATING, PIPING & AIR CONDITIONING

JOURNAL SECTION

OF
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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President's Message

Progress Report on ASHAE-*ASRE* Merger

When the Councils of ASHAE and *ASRE* met at their regular meetings in Minneapolis late in June, each Council re-affirmed in principle the method of merging the two societies developed by the Joint Committee on Cooperation. As a result, a formal joint statement was issued dated July 1, 1958. Those who are interested in reading the full text of this statement will find it on page 163 of this issue of the JOURNAL.

In the course of the meetings of the two Councils, the regional meetings, and the Advisory Board, many helpful and constructive comments and suggestions were forthcoming.

Also by the time of the last day of the meeting in Minneapolis, it seemed apparent that the principal features of the plan were in hand. Knowing that many members would be interested in having the latest information, I made a statement during the course of the fourth session of the Semi-Annual Meeting. In that statement, I outlined as fully as possible the nature of the merger plan. The essential features of that statement can also be found on page 161 of this issue of the JOURNAL.

In order that the plan as finally developed might embody as many of these thoughts and suggestions as possible, and in order that no time might be lost, the two Executive Committees arranged to hold a joint meeting in Chicago on July 18 and 19th. At that time, the proposals and plans were again carefully reviewed, and the essentials of a final merger plan were worked out.

As a result, I feel that we now are in a position to get together all the latest available information concerning the plan and have it mailed to the chapter presidents by August 15 and to all members of both societies not later than September.

I believe that in taking this action, the Councils are proceeding as rapidly as possible, but at the same time are making sure that they are taking into account the best suggestions and information available to them.

The Council has empowered the Executive Committee to finalize the plan with the Committee on Cooperation and the *ASRE* Executive Committee. Our Society's contractual obligations may necessitate balloting by our members at a special meeting on or before 1 December. Your Council will review and if they concur, approve the final plan and arrangements at its regular fall meeting in October.

It is a pleasure to report to you that the plan for the merger is progressing. I wish to take this opportunity to express my thanks to those who have given such careful thought and attention to the merger proposal. Your Officers need and welcome suggestions from all members.

E. R. Queer

PERSONNEL

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Editor

ANNE O'NEIL
Assistant Editor

Information on other Society personnel can be found on page 166.

Thermal Insulation for Nuclear Systems

By

C. G. Collins and G. W. Pomeroy

Mr. Collins is Supervisor of Applied Radiation Effects Research, Aircraft Nuclear Propulsion Department, General Electric Co. Mr. Pomeroy is Senior Engineer of Applied Materials Research Subsection of Aircraft Nuclear Propulsion Department, General Electric Co., Evendale, Ohio. A presentation at the Symposium on Thermal Insulation at the Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Minneapolis, Minn., June 24, 1958.

WHETHER or not one agrees that the nuclear revolution is here today or is still some years in the future, the fact remains that an increasing number of nuclear reactors are being built to produce useful energy and an increasing number of engineers and manufacturers are concerned with the selection and design of materials for these power plants. While much of this effort is simply the extension of current technology to an unusual type of heat source, some re-evaluation of materials and designs is necessary because of the presence of an additional environment—nuclear radiation particles—that effects materials properties and performance.

The purpose of this paper is to discuss the considerations the radiation environment imposes on the selection of thermal insulation materials. These materials have received comparatively little attention to date since most existing reactors are of a research type in which thermal efficiency is of minor importance. However, thermal insulation will be an important material as the nuclear industry strives to become economically competitive with other power sources.

Applications for Thermal Insulation

The requirements and applications for thermal insulation materials in a nuclear power plant are comparable to those in a standard power plant and it is only with respect to their response to the nuclear environment that selection of materials and designs differ from normal practice. Several possibly typical applications are shown in Fig. 1, the application areas being divided into 4 categories in which the thermal requirements as well as the nuclear requirements differ. In *area* 1, inside the reactor, the insulation would be subjected to the highest temperatures and to the most intense radiation levels. Here, it would be used to isolate the nuclear heat source and heat-transfer-fluid loop from the supporting structure. It would probably need to be a very efficient insulation material because of volume limitations and would need to be capable of fabrication into complex shapes. In *area* 2, outside the reactor core, the thermal and radiation environments are quite comparable to those in area 1; volume limitations and fabrication requirements would be much less severe. *Areas* 3 *and* 4 present the usual problems of insulation for heat exchangers and heat transfer loops; they are distinguished here only to indicate considerations due to the more intense nuclear environment in area 3. In *area* 4, the radiation might be reduced to a level safe for operating personnel and no difference would exist from standard insulation practices.

The response of the material to the nuclear environment must be considered in selecting insulation materials for use in the various areas. The environment is comprised principally of 2 types of nuclear particles, neutrons and gamma photons, which are produced in the fission process. Gammas and other types of nuclear particles such as beta rays, protons, and alpha particles are produced by the interactions of neutrons with various elements, hence, the radiation field in the vicinity of a specific material may be comprised of a number of types of nuclear radiations. One of the aspects of materials response to this environment is the absorption of neutrons; this can either interfere with the fission process or induce radioactivity in the material. Such reactions are important considerations in areas 1 and 3 respectively. A second aspect is radiation damage, *i.e.*, the production of changes in the chemical and physical properties of materials. The performance of a material in either of these respects can be the deciding factor in materials selection.

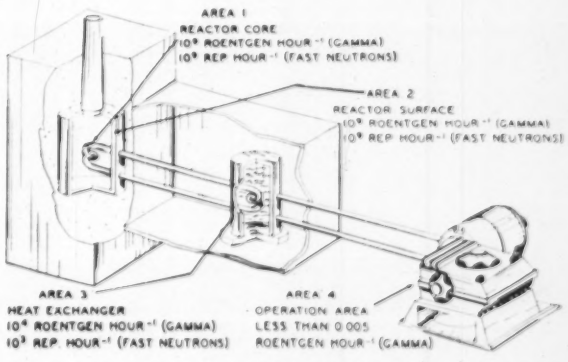


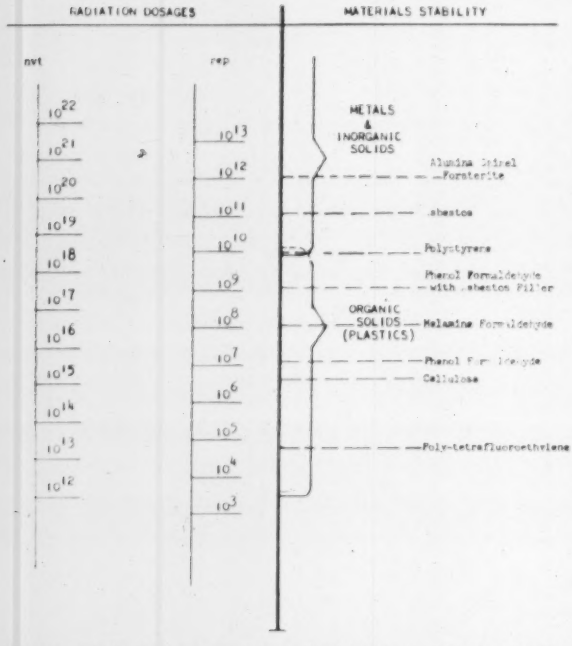
Fig. 1 — General areas of applications for thermal insulations and associated radiation levels

[1]This paper was prepared as part of an effort by the *American Society for Testing Materials*, Committee E-10, Subcommittee II, on Radiation Induced Changes in Materials to acquaint various materials committees and groups with the type and extent of materials problems to be encountered in nuclear technology. To support the work of specific materials committees, the efforts of Subcommittee II are directed toward standardizing both the measuring techniques used in determining the extent of property changes in materials as a function of radiation exposure and the terms used in describing the changes.

Absorption of Neutrons

Absorption of neutrons is used here to describe both the neutron removal and the induced radioactivity problems.

Neutron removal is an important consideration inside a reactor core. Efficient neutron absorbers either shorten the useful life of a reactor or increase the amount of nuclear fuel needed for a given power output since they remove neutrons that otherwise could contribute to the fission process. Except where they are deliberately placed in a reactor for control purposes, such absorbers are carefully avoided. Boron, cadmium, several of the rare earths, and lithium are well known elements in this category. The presence of significant quantities of these elements would mean that an insulation material would not be acceptable in area 1, significant quantities being in some instances in the parts-per-million range.



The nvt and the rep are both units used to describe a radiation field. The nvt specifically refers to the number of thermal neutrons that traverse 1 sq centimeter per sec; however, as it is used here and in much of the literature, it is a means of describing, with a single term, the entire reactor radiation field which is comprised of both neutrons and gammas over a spectrum of energies. The rep is a description of a radiation field in terms of the amount of energy the field will deposit in a reference material, one rep being the amount of radiation that will deposit 93 ergs per gram of tissue. The specific radiation field described here is that of a water-moderated reactor in which the ratio of particle types is approximately one rep of fast neutrons to one rep of gamma photons.

Fig. 2 — Relative radiation stability of types of materials

Artifically induced radioactivity is important where personnel must have access to materials or equipment. Almost all elements become radioactive upon absorption of neutrons, some much more so than others. For applications where frequent maintenance is necessary or desirable, such as area 3, induced radioactivity can pose a health hazard to operating personnel even though the reactor itself has been shut down or removed.

There is no general answer as to which elements should be avoided from the induced activity standpoint since all elements become radioactive to some extent. For each situation, the time of reactor operation, the quantity of the element present, the half-life of the isotope, the type of radiation emitted, and the time delay between the end of reactor operation and the beginning of maintenance operations must be considered. All radioactive isotopes follow exponential relationships in their production and decay, and since the 2 processes are concurrent, there will be an equilibrium quantity of isotopes formed under a constant neutron flux. The higher the flux of neutrons, the higher will be the equilibrium quantity of radioactivity. The equilibrium quantity is attained after 10 half-lives; even after 5 half-lives, over 95 percent of the equilibrium quantity will be produced. Similarly, after reactor operation ceases, over 95 percent of the activity will have died away after 5 half-lives, and it will have disappeared almost completely after 10 half-lives. Now, for equal quantities of radioactive atoms, many more atoms of a short-lived isotope will decay in a given time period, *e.g.*, an hour, than will those of a long-lived isotope. The short-lived isotope thus produces more intense radiation—and constitutes a greater health hazard to personnel—than does the long-lived isotope. On the other hand, a short-lived isotope of say 10-hr half-life, would completely disappear after 100 hr whereas an isotope of 30-day half-life would not disappear for 10 months. Hence, for maintenance in area 3, one might plan to begin operations one week after reactor shutdown; this would permit the short-lived activities to decay and would dictate that the elements to avoid would be those whose half-lives were of the order of 3 days to 2 or 3 weeks. Similarly, if maintenance were to begin one day after reactor shutdown, one would concentrate on trying to eliminate elements whose half-lives were of the order of 5 hours to a few days.

One or both of these aspects of neutron absorption is the reason manufacturers have received, or will receive in the future, queries on the elemental composition of their products and queries as to whether a particular element—probably in trace quantities—can be eliminated from the product.

Radiation Damage

Radiation damage to materials is the second factor of importance brought about by the radiation environment. While there exists at the present time no body of reference data, there are a number of generalizations and broad rules of radiation effects that can be used as guides to select thermal insulation materials.

An overall idea of the relative stability of different categories of materials can be gained from an examination of

Fig. 2. This chart is based on the radiation dosage required to produce measurable changes in materials. Where specific materials are indicated, a moderate amount of property degradation has occurred such as a 25 percent reduction in tensile strength. The chart also provides an approximation of the inter-relationship of some of the dosimetry units in common use.

Organic Materials

Organic materials are low on the scale of stability because they are damaged by both the neutrons and the gamma rays. The neutrons actually physically disrupt molecules through collisions with atoms, the struck atoms subsequently ionizing and exciting the surrounding material. The gamma rays impart energy primarily to electrons and these also ionize and excite neighboring molecules. In each instance, the ionization and excitation energy contribute to molecular breakdown. It is the nature of organic materials that where molecular fragments exist, a re-arrangement of the bonds within the fragment or a reaction between fragments will occur, and generally, the reactions will not reform the original molecule. The net result is a change in the chemical composition of the material and, therefore, a change in the properties of the material. Fig. 3 shows the property changes in paper; these are more or less typical of the types of changes that occur in organic solids.

Since organic solids generally have comparable thermal conductivity properties, the changes in composition should affect their normal conductivity only slightly; rather, the problem with organic insulation will be the physical deterioration of the material. Referring to Fig. 3, one might assume that a paper or felt might be used to a dosage of around 10^8 rep and that from Fig. 2 the best organic material might be used to a dosage of around 10^9 rep. By comparison with the dosages in the various application areas, it is apparent that organic materials could not be used for more than 100 hr, at the most, inside the reactor core (area 1). The usefulness even in area 3 would not compare with the normal lifetime expected of these materials.

Organic materials are frequently used in combination with inorganic materials to produce insulation materials. Since the inorganic solids are much more stable to radiation than are organic compounds, the utility of the insulation will depend on the degree to which the organic is a necessary part of the composition. Obviously, where the organic is simply an adjunct to the manufacturing process and is burned-out either in manufacturing or in the application, its presence can be ignored in choosing a material. However, where the organic serves as a binder and provides mechanical integrity to the material, the insulation will be subject to the same limitations of physical deterioration at high dosages as are the all-organic compositions. There is one exception; if the organic is present in small thicknesses or films, it will withstand longer exposure to radiation than will an all-organic composition simply because it offers a smaller target to the radiation particles. A silicone resin, for example, that might be rated at 10^8 rep on the chart of Fig. 2, might well withstand exposure to 10^{10} rep as a binder before physical deterioration became excessive. Nevertheless, organically bonded insulations would not be desirable in the core or on the surface of a reactor even if the temperatures permitted their use; their use in area 3 appears possible however.

Inorganic Solids

Inorganic solids are orders of magnitude more stable than organic materials. This greater stability is due, in part at least, to the fact that mechanical damage is due

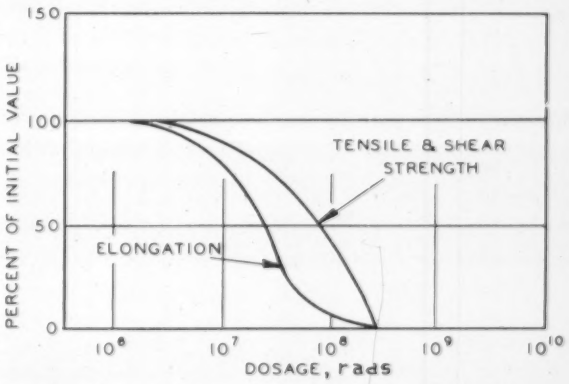


Fig. 3 — Effect of irradiation on physical properties of paper

almost exclusively to the neutrons, gamma photons having a very small effect on deterioration of the material. The damage process consists of the alteration of the crystal structure due to the transfer of kinetic energy from neutrons to atoms. Struck atoms are displaced from their normal lattice positions into interstitial positions and leave vacant sites in the lattice. The effects of these processes include lattice expansion, decreased density, and changes in the strength, electrical, and thermal properties. The magnitude of the changes appear to depend upon the elemental composition, the crystal structure, the type of chemical bonding, the amount of radiation, and possibly other factors. In the dosage range from 10^{19} to 10^{20} nvt, the density changes appear to be of the order of 1 to 6 percent for compounds of poor to moderate radiation stability. Wittels[1] reported a density decrease of 3.5 to 5 percent in α quartz at 6.6×10^{19} nvt. Primak, Fuchs, and Day[2] noted lattice expansions of 1 and 3 percent respectively for silicon carbide and diamond at dosages in the same range

[1] Exponent numerals refer to References.

and indicated that magnesium oxide, sapphire, and spinel were stable to somewhat higher dosages. Sisman, Bopp, and Towns[3] found small density changes (<1.0 percent) in MgO and no changes in Al_2O_3, spinel and forsterite at 2×10^{20} nvt. All of the crystalline materials examined have exhibited a lattice expansion and decrease in density. On the other hand, an *increase* in the density of the amorphous material, vitreous silica, was observed by Primak, Fuchs, and Day[2] and Wittels and Sherrill[4]; Primak and Fuchs[5] cited a 17 percent increase in the density of this material at a dosage that was probably well above 10^{20} nvt. The density increase in the vitreous silica leads to the speculation that amorphous solids generally will exhibit anomalous behavior in comparison to crystalline solids.

Certain aspects of the extent of damage in inorganic solids with increasing dosage are of great practical importance. One of these is the fact that damage is not directly proportional to dosage. In the initial phases of irradiation, increasing numbers of atoms are displaced approximately in direct proportion to the dosage. As irradiation continues, however, the number of atoms that have been displaced at least once becomes a significant percentage of the total number present. Making the reasonable assumption that moving an atom from one non-normal position in a crystal to another will not further alter the gross properties, it is apparent that after considerable irradiation, the efficiency of the collisions in altering the material will be less than the initial efficiency — it is even likely that some of the collisions will displace atoms from non-normal lattice positions. Ultimately, therefore, an equilibrium condition of disorganization is reached and further irradiation will have no effect. In addition to this consideration, there is the possibility that, because the displaced atoms are in energetically metastable positions, such migration of atoms as occurs from vibration due to thermal energy — even at room temperature — will favor migrations in which atoms regain normal lattice positions. Still further, a process of *radiation annealing* has been postulated by Seitz[6], Brinkman[7], and others[8,9,10] in which the replacement of atoms is implemented during the collision process. One or all of these concepts is apparently correct, for damage (in terms of lattice expansions) in crystalline solids appears to follow a curve of the general type shown in Fig. 4. To the extent that they are directly related to changes in the crystal lattice, other property changes should exhibit similar behavior.

Thermal annealing of the radiation damage is also an important factor from the practical standpoint. As the temperature is increased, the magnitude of thermal vibrations is accelerated and atomic migration proceeds at an accelerated pace. When irradiated solids are maintained at elevated temperatures, the atomic movement permits atoms to regain normal positions. Hence, the radiation effects are cured or *annealed*. The annealing does not appear to follow an exponential relationship with temperature; rather, specific activation energies for curing various types of crystal defects appear necessary. Nevertheless, some annealing occurs at any given temperature and temperatures of 1800 F to 2000 F effectively completely anneal radiation effects. Thus, it is expected that irradiation at high temperatures will yield an equilibrium amount of damage that is less than that observed in room-temperature irradiations, and that a sufficiently high temperature will essentially eliminate radiation effects. It is fortunate that the most intense radiation area in nuclear applications (area 1) is also the one in which the highest temperatures will prevail.

The thermal conductivity of inorganic solids decreases under irradiation, the materials becoming better insulators.

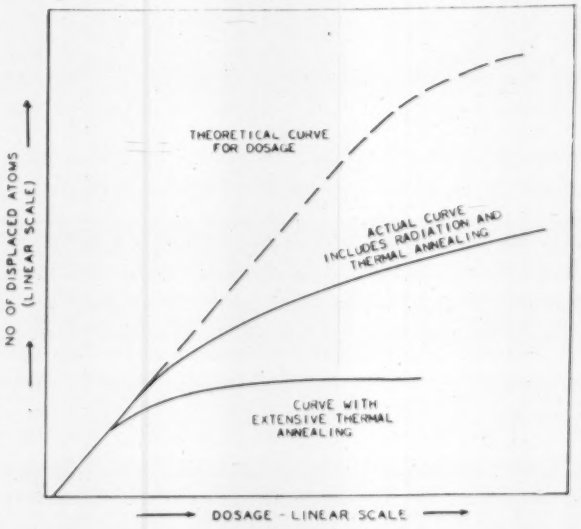

NO OF DISPLACED ATOMS (LINEAR SCALE)
THEORETICAL CURVE FOR DOSAGE
ACTUAL CURVE INCLUDES RADIATION AND THERMAL ANNEALING
CURVE WITH EXTENSIVE THERMAL ANNEALING
DOSAGE - LINEAR SCALE

Fig. 4 — Atomic displacements as a function of neutron dosage and annealing

This is in accord with theoretical expectations. Since thermal energy is transferred through an insulator solid by means of the vibrations of the atoms, the presence of vacant lattice sites, displaced atoms, and other crystal defects perturb the energy transfer and have the effect of decreasing the thermal conductivity. Some thermal energy is also transferred by means of electron excitation and, since electrical conductivity is increased by irradiation, some increase in the electronic contribution to thermal conductivity might also be expected. This effect is apparently small, since the observed change in overall conductivity is usually a decrease.

Fig. 5 shows data indicative of the magnitude of the decrease in thermal conductivity for several compounds as reported by Sisman, Bopp, and Towns[3], and by Morgan and Baxter[11]. The conductivity of the mineral fiber-batt insulation described by Morgan and Baxter was measured during irradiation at 1650 F; that of the other materials

was measured at approximately 100 F after irradiation at 100 F to 200 F. The curves indicate that steady state values are attained by Al_2O_3, TiO_2, MgO, and the mineral fiber. This conforms with expectations for crystalline materials that a saturation level of the number of displacements and of the amount of lattice distortion would be reached. The curve for oven glass shows the somewhat anomalous behavior that may be expected in an amorphous material.

Since the thermal properties of the inorganic solids are not adversely affected by radiation, the design and selection of materials for the ultimate in radiation stability centers around avoiding the problems resulting from lattice expansion. The most stable insulation materials, obviously, are the pellet and fibrous materials since in these the expansion poses no problem. Such insulation also meets the requirement that it be capable of being formed and fabricated into complex shapes and geometries. Materials of this type appear best suited for use in the reactor core or on its surface. The expansion problem in solid slab or brick insulation could necessitate special designs or sizes to obtain the best performance if such a material were used in the reactor core or on the reactor surface. In a solid block of insulation oriented with the thickness normal to the radiation field — as might be the case in area 2 — the thermal gradient will be greater than the radiation gradient. Thus, in a 2-in. thickness, for example, there would be nearly uniform radiation damage but varying degrees of thermal annealing through the material. Internal stresses would develop because of the greater expansion in the low temperature portion. Whereas the thermal expansion in a good insulation material may be only of the order of 0.5 percent, the expansion due to radiation damage may range up to 10 percent at high dosages. Hence, mechanical stresses can develop that are large enough to disrupt many of the standard thicknesses of insulation slabs or bricks. The solution to this problem would be a combination of the selection of materials that are stable to radiation such as alumina, spinel, and forsterite, and the utilization of thinner than normal bricks or slabs with the slab thickness oriented normal to the radiation field.

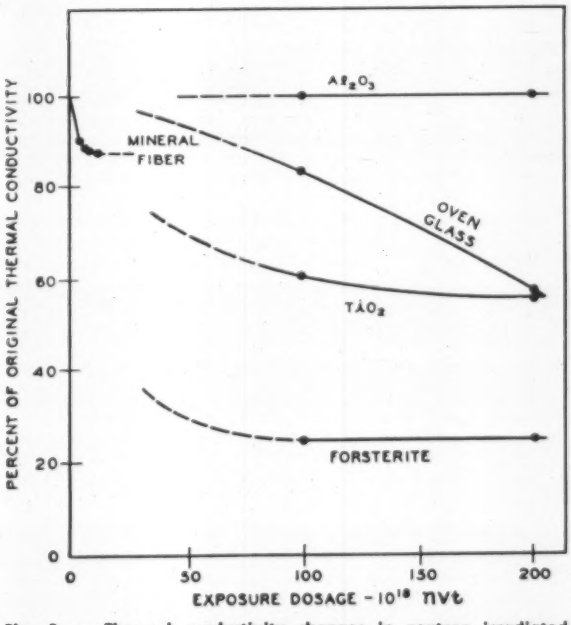


Fig. 5 — Thermal conductivity changes in neutron irradiated ceramic materials

Conclusions

Applications for thermal insulation in a nuclear reactor have been discussed in the light of requirements imposed by the environment of nuclear radiation particles. These requirements in terms of materials selection include for some applications the avoidance or elimination of neutron absorbers in the insulation material and in all applications the selection of radiation stable materials.

Applications in which neutron absorbers should be avoided or minimized include insulations used in the reactor core or in areas where some degree of personnel access is required. Neutron absorbers in materials inside the reactor core unnecessarily remove neutrons that might otherwise contribute to the fission process. Widely known elements in this category include boron, cadmium, several of the rare earths and lithium. Neutron absorbers in insulation materials in areas to which personnel must have access contribute to the artificially induced radioactivity and thereby increase the hazard to maintenance personnel. In this sense, almost all elements are neutron absorbers. No general statement can be made as to specific elements to be eliminated rather the composition of materials must be determined from considerations of the reactor operating time, the time delay between reactor shutdown and the beginning of maintenance operations, and the radiation levels to be permitted.

In all applications of thermal insulation materials in a nuclear power plant materials must be selected whose radiation stability is compatible with the radiation environment and the anticipated lifetime. From general consideration of radiation damage, the organic insulation materials are limited to areas that are outside the reactor core or its immediate vicinity. Inorganic or ceramic insulation materials appear sufficiently stable for use in any reactor application. Indications of existing data are that the inorganic solids expand during irradiation, hence, the design of thermal insulation using ceramics involves avoiding problems created by the expansion. It is concluded that the fibrous and pellet types of insulation are the most stable for applications inside the reactor or on its surface.

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SOLAR ENERGY FOR RESIDENTIAL USES

Addressing the seventh annual Meeting of the *Building Research Institute* in Washington, John I. Yellott, executive vice president, *Association for Applied Solar Energy*, Phoenix, Ariz., presented a paper entitled The Impact of Solar Energy upon the Building Industry. What follows here is extracted and abstracted from that paper.

As regards the matter of using solar energy to power a refrigeration cycle for residential use, at present, the only process for producing refrigeration by use of heat requires temperatures above the normal output of flat plate collectors (about 140 F). Because of this, attempts to produce cooling from sun heat have made use of parabolic troughs or similar devices to generate low pressure steam for a conventional absorption process. This has been done on a small scale at the French solar laboratory at Mont Louis, at the *Helio-Technical Institute* in Tashkent, Russia, and in a few places in the United States. The team working at the University of Wisconsin under the direction of Farrington Daniels has done work on this but no manufacturer has yet developed a marketed solar refrigerator or air conditioner.

During recent years several types of plastic films have been developed which have virtually the same heat-trapping characteristics as glass, but which can be installed at considerably lower cost. Manufacturers have developed ways by which tubes can be formed as integral parts of metal sheets so that tubed strips of literally any desired length can be produced in either copper or aluminum.

During the past 10 years, a number of buildings have been erected which derive most of their heat from the sun.

One is the office building of Bridgers and Paxton in Albuquerque. The solar heat collection surface is the entire south-facing wall inclined at an angle of 60 deg to the horizontal. The collectors which are mounted on this wall use a single glass cover plate and absorb the sun's heat on blackened sheets of aluminum to which copper tubes are soldered. This building uses a heat pump as a means of up-grading heat collected from the sun to temperatures high enough to do the heating job within the building.

The combination of solar collectors and the heat pump enables comfortable conditions to be maintained at all times with minimum use of fossil fuels.

A residence built in Denver by George Löf uses glass air heaters. For heat storage, tall cylinders filled with gravel are used and the auxiliary heat is supplied by an oil furnace. Domestic hot water is obtained by means of a solar water heater which is heated by air coming from the collectors. Auxiliary electric strips keep a supply of hot water available during periods of low sunshine.

The MIT solar house recently completed at Lexington, Mass., uses water as its heat collection, transfer, and storage medium. Its south-facing roof is completely covered by a collector which consists of copper tubes fastened to blackened sheet aluminum, with glass as the covering material. A 1500-gal tank in the basement is used as heat storage and the house is warmed by a heat exchanger which transfers heat from the hot water to air circulating within the house. Auxiliary heat is supplied by an oil-burning furnace. A coil is provided within the storage tank so that air-conditioning equipment can be installed which will chill the water in the tank and use the heat exchanger to air condition the house.

A solar house was recently built in Phoenix as a cooperative undertaking by the *Phoenix Association of Home Builders* and the *Association for Applied Solar Energy*. Thanks to a grant from the John B. Pierce Foundation it was instrumented so that measurements can be made of the performance of every component within the house. During the next year, it will be on public display and it will also serve as a living laboratory to study the use of solar energy for heating, and of the various means incorporated within the house for minimizing the cooling load.

The design of this house is based on a prize-winning design by P. E. Lee, an undergraduate student at the University of Minnesota. The house has two wings, located on both sides of a central court. Glass is used in the east-west walls, and screen walls are used along the east and west sides of the house. The outstanding feature of the design is the use of movable louvers to produce shade in the summer and to collect solar heat in the winter. The collectors consist of aluminum panels, which are built around wooden frames. Copper *tube-in-strip* is used as the heat absorbing surface. Double glazing is used, with one thin film of plastic stretched directly over the *tube-in-strip*, and a second heavier film used to cover the opening in the aluminum panel.

The heat which is collected in 15 rows of louvers, each containing 4 panels, over the south patio, the central court, and the north wing, is used to heat both the house and the swimming pool. Water from the 2000 gal buried storage tank is pumped first through a grid of 500 ft of copper pipe in the base of the swimming pool; the water then goes to the solar collectors. The collectors are automatically rotated each morning at sunrise so that they face the south and at sunset they turn down so that their reflective aluminum backs face the sky. During the summer, they remain in the face-down position to serve as shade-producing devices.

In summer, the solar collectors are not used, but heat pumps go into their cooling cycle in response to a command from the thermostat.

While the Phoenix house is undoubtedly the *Rolls Royce* of solar houses, it is by no means necessary to make use of such elaborate equipment. A completely different house has been built as a feature of the U. S. exhibit at the Casablanca Trade Fair in Morocco. This house uses simple finned aluminum air heaters, and a pebble-tank storage system. The auxiliary heat is an open fireplace.

Between the comprehensive systems in use in Albuquerque, Denver, Lexington and Phoenix, and the ultra-simplified system designed for Casablanca, there are an infinite variety of designs which can be used so that sunshine can supply much, if not all, of the heat requirements of a particular residence.

Economic Evaluation of Condensing Methods

By

James L. Wolf

The author is a Consulting Engineer, Philadelphia, Pa. A presentation at the Symposium on Condensing Methods at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 25, 1958.

PRACTICAL technological development, as reflected by the availability of standard, essentially prefabricated refrigeration equipment, is a most significant factor in the selection of condensing equipment.

Obviously, any proposed solution can be ultimately related to overall owning and operating cost but there are certain less tangible characteristics which are compelling, although not necessarily conducive to finite economic evaluation.

At a given time, certain equipment may have indisputable prowess for certain ranges and applications. In the small commercial field, for example, the air-cooled condensing unit has no peer while the centrifugal water-cooling machine, available in any size between 60 and 1000 tons, has outstanding advantages for everyone who comes in contact with it, from original conception to actual operation and maintenance. In the middle range, where one formerly thought in terms of field assembled plants, with the flexibility but required ingenuity of specifically selecting or designing components, the packaged reciprocating water-cooling unit has been steadily improved and now is rightfully accepted as a useful and competitive basic method of providing the required cooling effect.

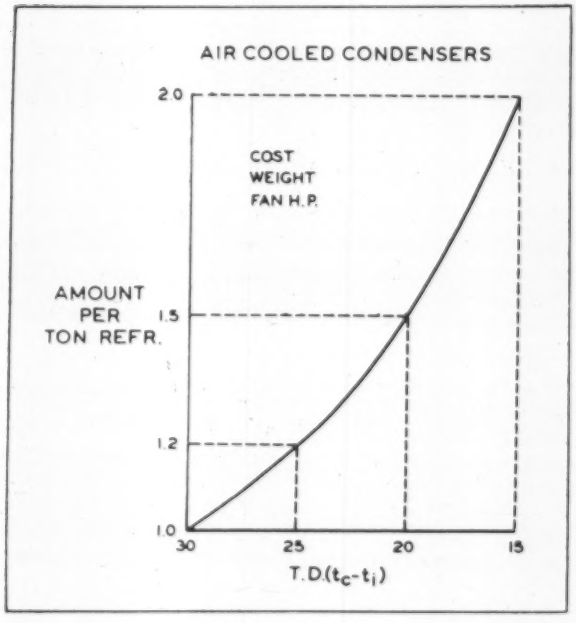

Fig. 1 — High-side relation between condensing temperature and cost, weight and fan hp of air-cooled condensers

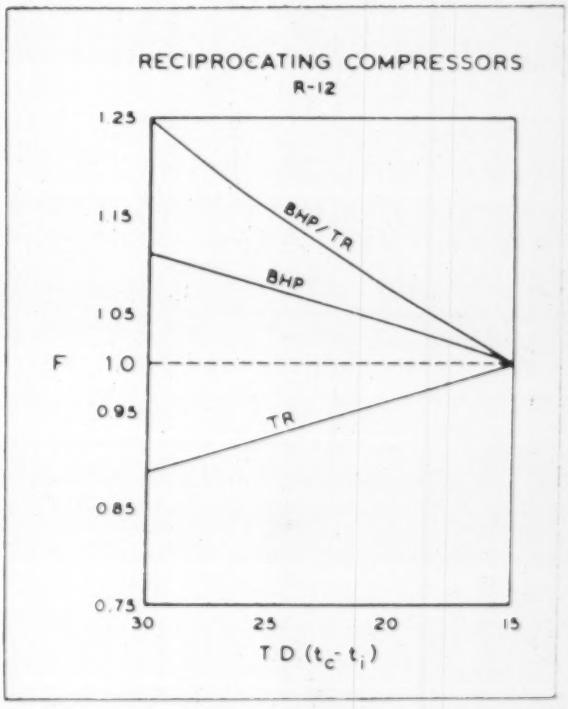

Fig. 2 — Changes in compressor performance with change in condensing temperature

But the situation has changed and will continue to change. As was well emphasized in a preceding paper, remote air-cooled condensers, for virtually any capacity, are definitely available and there is good reason to believe that even the application of an air-cooled condenser for a centrifugal machine is imminent or perhaps *fait accompli* at this time.

Comparative thermodynamic and economic analyses, no matter how valid and indicative, invariably must yield to the practical considerations of space, weight, appearance,

noise, simplicity of installation, continuity of service without undue attention, automatic capacity control and minimum recurrent maintenance.

One may have felt that he wanted to avoid water treatment, to say nothing of water cost, sewer rent and cleaning of pans or sumps but there were probably other and equally important considerations which dictated the use of a water-cooled condenser.

Assuming that there is a choice which may be influenced or even resolved by overall owning and operating cost, one must then examine the specific characteristics of equipment available and acceptable for the application, determine the required capital expenditure and utility requirements on a functionally comparable basis and then apply cost figures which are realistic and meaningful.

A 105 F condensing temperature is not a magic number. Fig. 1 shows the importance of preparing a specific high side balance. To attain 105 F with a 90 F ambient, per ton would require exactly twice as much air-cooled condenser, in cost, weight, cfm and fan horsepower, as would be required for 120 F condensing temperature. The best solution for a given job is probably somewhere between the two.

At the same time, as indicated in Fig. 2, one must recognize a decreasing capacity, an increasing horsepower requirement and a marked increase in brakehorsepower per ton as the design condensing temperature increases.

People speak glibly of maintenance costs but frequently fail to assign a true price tag for the actual attention required. Fig. 3, for example, shows the average cost of complete water treatment for recirculating systems or evaporative condensers using city water make-up in the northeastern U. S. For a 100 ton plant, the cost will be $1.50 per thousand ton-hours of operation or $375 for a month of normal air-conditioning service during business hours and the actual cost for water is usually comparatively insignificant. These figures will be surprising to many, but this is the actual recurrent cost which must be anticipated to prevent even more troublesome and costly overhaul and repair.

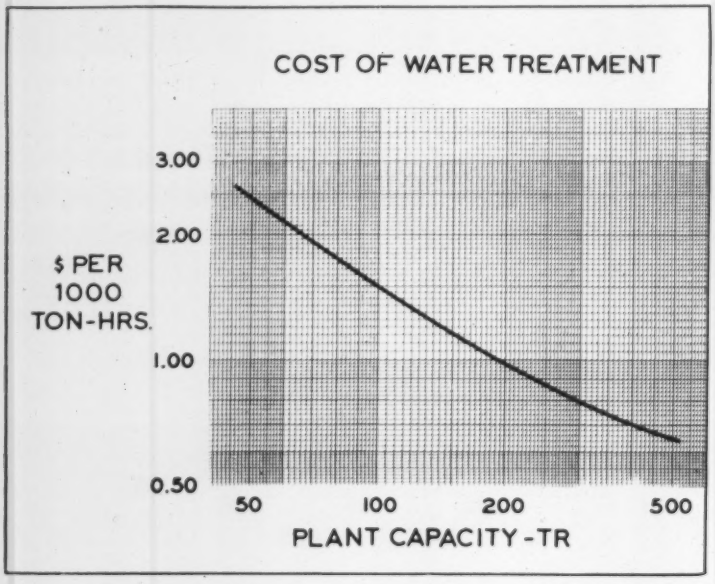

Fig. 3 — Average cost of complete water treatment for recirculating systems or evaporative condensers using city water make-up in the northeastern U.S.

Thus, it is apparent that the analysis must be made on the basis of specific factual data. There are few, if any, shortcuts and the cost differences are usually appreciable. Then, at least, the final actual decision can be made with full appreciation of the price being paid for the less tangible considerations.

Make Plans Now for 65th Annual Meeting

Philadelphia, Pa., January 26-29, 1959

Supply Outlet Locations for Basement Heating†

By J. R. Wright* and D. R. Bahnfleth**, Urbana, Ill.

SUMMARY—Performance data are presented for several types of supply outlets used in an investigation of basement heating in Warm Air Heating Research Residence No. 2 at the University of Illinois. The outlets studied were ceiling diffusers, warm-air perimeter diffusers, and low inside wall registers. Two basement return-air grille locations were used. Room-air temperatures were controlled by a thermostat located on the first story. Outlets which discharged the air horizontally at floor level produced the smallest temperature differentials and gradients. The warmest floor was achieved by locating the supply outlets at the perimeter. On the basis of day-to-day temperature difference between rooms, zone control was not considered necessary; however, during periods of light load when solar heat gains and internal gains from cooking maintained comfortable temperatures on the first story, the basement temperatures dropped to uncomfortable levels.

THE CEILING or high sidewall type of supply outlet has been commonly used in warm-air heating systems to heat basement rooms. Large room-air temperature variations and cool floors have resulted. This type of basement heat addition provides warm floors in first-story rooms[1,2] but does not produce satisfactory comfort for extended occupancy in the basement space. The increasing use of basement rooms for recreational and living purposes suggested the need for an investigation to determine desirable supply outlet locations for heating these rooms. In addition, a related problem has been found in multi-level houses having rooms with concrete slab floors at or below grade. Large floor-to-ceiling temperature variations and cool floors occur in the lower level rooms of this type home when warm air is supplied to the rooms through overhead supply outlets. A warm-air perimeter system employing ducts embedded in the concrete slab floor would eliminate the unsatisfactory comfort conditions experienced. An embedded perimeter system may be used in new construction, but installation of embedded ducts is not economically feasible in existing structures. It was felt that a part of the results of this investigation would be applicable to multi-level type structures.

This investigation was conducted in Warm Air Heating Research Residence No. 2 for the purpose of satisfying the following objectives:

1. To determine the effect of supply outlet location in a basement room on:

(*a*) air temperature variation; (*b*) floor-surface temperatures; (*c*) room-air velocities; (*d*) fuel consumption.

2. To determine the cyclical variation of basement-air temperature in a system in which the thermostat was located on the first story.

Description of Residence

The residence, which has been described[1] in detail was a one-story frame structure with full basement. Walls were insulated with 3½-in. mineral wool blanket-type insulation with vapor barrier attached. Ceiling was insulated with 5 in. of mineral wool. The calculated coefficient of heat transmission, U, for the walls and ceiling was 0.07 Btu per (hr) (sq ft) (F deg). Windows on the first story, with the exception of the double-glazed fixed window in the living room, were of the horizontal sliding type with storm sash attached to the window sash. First-story doors were of conventional wood and glass construction and equipped with storm doors. Windows were weatherstripped.

A room was made in the basement by erecting partitions in the openings between the south and north sections of the basement. The room is shown on the basement plan in Fig. 1. The partition was of 2 × 4-in. stud construction with a finish gypsum board panel on the test room side only. The test room in the south half of the basement had a floor area of 507 sq ft (39 × 13 ft) with glass areas of 33 and 16.5 sq ft on the south and west exposures, respectively. Basement windows were of the horizontal sliding type and were larger (56 in. wide × 41 in. high) than conventional basement windows. Two such windows were located in the south wall and one in the west wall. Basement windows were single glazed. There was no storm door on the grade level entrance, which opened into the basement stairwell. The door and windows were weatherstripped.

The basement wall construction is shown in Fig. 2. The above grade portion of the wall consisted of approximately equal parts of 10-in. lightweight aggregate concrete block plastered outside and frame insulated with 3½-in. mineral wool insulation. The below grade portion of the walls consisted of 10-in. lightweight aggregate concrete blocks plastered outside. At window sections the surface of the concrete floor was approxi-

† This investigation was part of the cooperative project jointly sponsored by the Engineering Experiment Station of the University of Illinois and the *National Warm Air Heating and Air Conditioning Association*.

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** Assistant Professor of Mechanical Engineering, University of Illinois. Associate Member of ASHAE.

[1] Exponent numerals refer to References.

For presentation at the 65th Annual meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Philadelphia, Pa., January 1959.

mately 3 ft below the surface of the gravel placed at the bottom of the light wells. At other sections the floor surface was approximately 7 ft 6 in. below grade. The east basement wall, with the exception of the frame portion and one course of block above grade, was protected by an attached garage and a concrete driveway.

The design heat loss of the basement and the stairway, calculated in accordance[3] with *Manual No. 3*, was 15,515 Btu per hr for design temperatures of −10 F outdoors and 70 F indoors. This amounts to 29.9 Btu per (hr) (sq ft) of floor area, which is approximately equal to the average heat loss of the lower level rooms investigated in field studies. The design heat loss of the first story was 31,047 Btu per hr, for a total design heat loss of 45,562 Btu per hr.

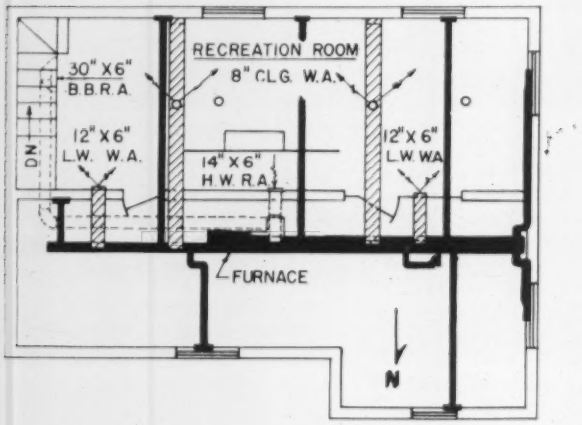
One major cause of temperature unbalance in multi-level houses is the interchange of air between floors through open stairwells. During heating, cool air from the upper levels collects in the lowest level, while warm air from the lower level moves to upper levels. To allow this interchange of air in Research Residence No. 2, the door between the kitchen and the basement stairway was removed throughout the investigation.

Duct System and Basement Supply Outlet Locations

The small-pipe perimeter system which had been used during recent year-around air-conditioning investigations was used to heat the first-story rooms. The system, shown in black in Fig. 1, was of the extended-plenum type having an 8 × 8-in. trunk and a 14 × 8-in. trunk extending east and west, respectively, from the furnace bonnet. The 9 branch ducts were of 4-in. diameter, and the supply outlets were 2¼ × 14-in. floor diffusers. The central return-air grille was located in the entrance hall on the first story.

The duct system in the basement, which is cross-hatched in Fig. 1, was designed to provide for the several supply outlet locations shown in Figs. 1 and 3. The locations include 2 ceiling outlets (see Fig. 1), free discharge from 2 ducts with tees to direct flow along the outside wall (Fig. 3A), two 12 × 6-in. low sidewall diffusers on the outside wall (Fig. 3B), four 2¼ × 14-in. floor diffusers on extended ducts at the outside wall (Fig. 3C), and two 12 × 6-in. low sidewall registers on the inside wall (Fig. 1).

Two basement return locations, shown in Fig. 1, were used during the investigation. Only one of the basement returns, together with the first-story return, was used in any one series. The return not in use was sealed at the connection to the central return duct.



R.A. shows return air openings; W.A. shows warm air openings; B.B. shows baseboard openings; H.W. shows high sidewall openings; L.W. shows low sidewall openings; circles show locations of thermocouple standards.

Fig. 1 — Basement plan and duct layout of first-story system (black) and basement branch ducts (cross-hatched)

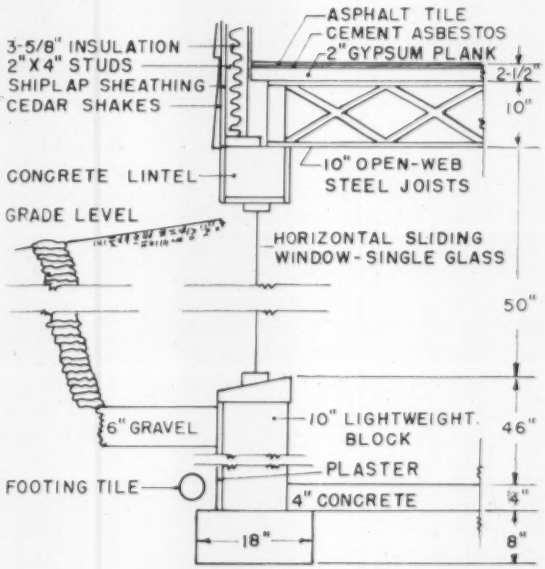


Fig. 2 — Basement construction

Experimental Conditions

The heated space consisted of the first-story rooms and the room in the south half of the basement. The thermostat, which was located in the first-story was set to maintain a temperature of approximately 73 F at the 30-in. level. The basement-air temperature was controlled by the same thermostat as the system did not include zone control.

The fuel-input rate was set at 58,200 Btu per hr in all studies. This corresponded to the calculated heat loss divided by an assumed bonnet efficiency of 80 percent and an assumed duct transmission efficiency of 100 percent. Natural gas having a heating value of 1000 Btu per (hr) (cu ft) was the fuel used.

The system was adjusted in accordance with the CAC principle[4], and the system air-flow rate was set to obtain a 100 F air temperature rise through the furnace. The calculated air-flow rate for this condition was 430 cfm. The limit control was set to cut out at 200 F and cut in at 175 F. The fan switch was set to cut on at 100 F and cut out at 80 F.

The house was furnished and occupied by a family of 2 adults during the investigation.

The basement supply outlet location and the basement return-air grille location were the controlled variables in the investigation. The test series and the supply and return locations are listed in Table 1.

Experimental Procedure

All significant temperatures, electrical and gas consumption, and weather variables were recorded daily. In addition, special studies were made to determine basement-air temperature and velocity variation in the floor and sitting level planes, cyclical variations in basement and first-story air temperatures under various load conditions, supply-air characteristics, and branch air-flow rates.

Comfort depends upon many variables, but in this paper the systems studied have been evaluated on the basis of room-air and floor-surface temperatures and room-air velocities. The subjective factors of odor, dust content and noise could not be evaluated.

At the beginning of each series, the branch dampers were adjusted to obtain satisfactory temperature balance between the basement and first story, and between rooms. These adjustments were made during average winter weather and under nighttime operating conditions to avoid the influence of solar radiation. All temperature data were collected at 6:30 a.m. when the effects of sun and occupancy were negligible, and all temperatures reported, unless otherwise noted, were based on these readings.

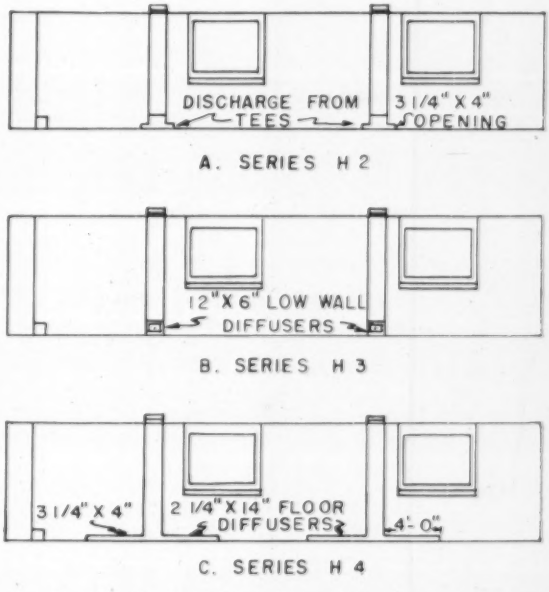

DISCHARGE FROM TEES
3 1/4" X 4" OPENING
A. SERIES H 2
12"X 6" LOW WALL DIFFUSERS
B. SERIES H 3
3 1/4" X 4"
2 1/4" X 14" FLOOR DIFFUSERS
4'-0"
C. SERIES H 4

Fig. 3 — Perimeter warm air supply outlet arrangements at exposed south wall

Table 1 — Supply outlets and return-air combinations studied

Test Series	Basement Supply Outlets			Basement Return-Air Grille
	No.	Type	Remarks	
H 1	2	Ceiling Diffusers		Baseboard[a]
H 2	2	Open Tees	Free discharge along outside wall	Highwall[b]
H 3A	2	Low Sidewall Diffusers	Air directed upward along outside wall	Highwall
H 3B	2	Low Sidewall Diffusers	Air directed onto floor	Highwall
H 4A	4	Floor Diffusers	On extended ducts at outside wall	Highwall
H 4B	4	Floor Diffusers	On extended ducts at outside wall	Baseboard
H 5	2	Low Sidewall Registers	On inside wall at floor level	Highwall

[a]Baseboard return was located at base of stairway to the first story.
[b]Highwall return was located near the center of the inside basement wall at ceiling level.

Results

The several types of supply outlets used may be divided into 3 groups according to the way in which conditioned air was discharged into the space. The 3 groups and the types of outlets included in each group are: horizontal discharge at ceiling level, ceiling diffusers; horizontal discharge at floor level, inverted low sidewall diffusers, open tees and low inside wall registers; and vertical discharge at floor level, floor diffusers on extended ducts and low sidewall diffusers. The performance

of the ceiling diffusers, low inside wall registers and floor diffusers was representative of the outlets in each of the 3 groups and, in general, only the studies with these outlets are discussed.

Supply and Room Air Velocities: The *supply air characteristics* for each outlet except the ceiling diffusers are shown in Fig. 4. Isovels are indicated for velocities of 100 and 200 fpm. Supply air characteristics were obtained by measuring velocities at a number of elevations and distances from the centerline of the west basement supply outlet. The 100- and 200-fpm jet isovels were then graphed. The burner was permitted to operate during the time that the velocities were measured, and the average supply-air temperatures for the series shown were 95 F and 93 F in Series H 4 and H 5, respectively.

The ceiling diffusers distributed air equally in all directions and the primary air was parallel to the ceiling. Velocities beneath the outlet were not of sufficient magnitude to be noticeable. The air in the living zone was nearly stagnant, which is in agreement with the results[5,6] of a laboratory study of air distribution.

The floor diffusers installed at the end of the extended ducts (Series H 4) had vanes which were deflected progressively from 0 deg at the center to about 42 deg at the ends. The primary air was not spread as would be expected with this type of outlet because the air was delivered to the outlet from one end. The deflection of the single jet suggests that most of the primary air passed through that half of the vanes having the same deflection as the jet. The 100-fpm isovel was approximately 5 ft above the floor at its highest point.

The vanes of the conventional low sidewall registers used on the inside wall (Series H 5) were deflected approximately 22 deg on each side of center, and a 2 jet outline was obtained at the 1-in. level. The throw of the west half of the jet was less than that of the east half because of the influence of a nearby cabinet. The 100-fpm isovel of the east jet extended 6 ft into the room at the 1-in. level, and at its widest point the 100-fpm isovel was about 7 ft wide. The maximum velocity measured at the 6-in. level was 80 fpm, and the average at the same level and immediately above the primary air was 50 fpm.

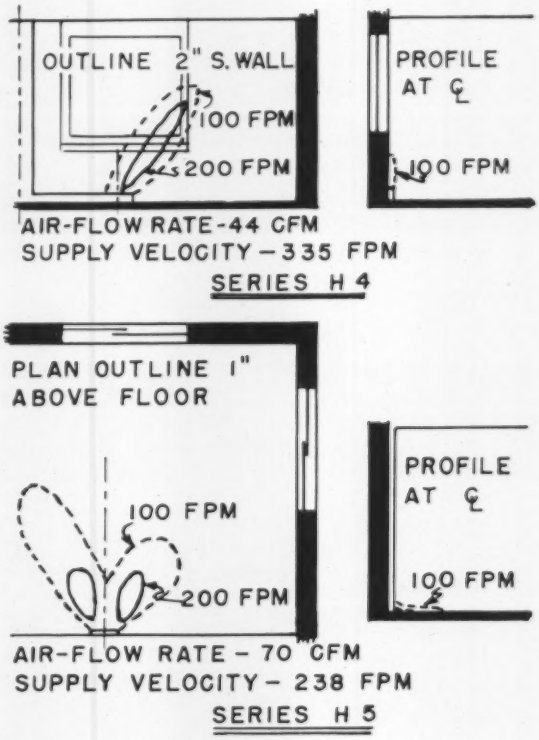


Fig. 4 — Supply air characteristics for floor diffusers on extended ducts (H 4) and low inside wall registers (H 5)

Table 2 — Basement-air velocities at sitting and floor levels

Supply Outlet		Horizontal Discharge at Floor[a]				Vertical Discharge at Floor[b]			
Supply-air Temp. F		103.0				95.0			
Level		Floor (4 In.)		Sitting (30 In.)		Floor (4 In.)		Sitting (30 In.)	
Stations		W[c]	E[d]	W	E	W	E	W	E
Velocities, fpm									
	Avg	38	31	28	28	25	29	26	27
	Max	90	45	45	50	45	45	33	60
	Min	20	20	20	15	18	20	20	20

[a]Series H 3B — Horizontal jet perpendicular to exposed wall.
[b]Series H 4 — Vertical jet parallel to exposed wall.
[c]W stations were in west half of basement (35 stations).
[d]E stations were in east basement within 4 ft of staircase (18 stations).

Basement-air velocities at the 4-in. and 30-in. levels measured in the west half of the basement and in the east end of the basement within 4 ft of the stairway during 2 test series are listed in Table 2. The maximum velocities at the 4-in. and 30-in. levels with horizontal discharge at floor level (Series H 3B) were measured directly in front of the outlet. The average velocity at the 4-in. and

30-in. levels was not excessive. The basement-air velocities measured with the floor diffusers located on the top of extended ducts were generally smaller in magnitude than those measured with other outlets. Since the primary air from the floor outlets did not extend any appreciable distance into the room, lower velocities would be anticipated. The maximum velocities were measured near the window in the west half of the basement and near the stairway in the east half of the basement.

Uniformity of Room-Air Temperatures: Representative 30-in. level room-air temperatures for each first-story room and the basement are listed in Table 3 for average weather.

Table 3 — Room-to-room temperature balance at sitting (30-in.) level

Series	H 1	H 4	H 5
Outdoor Temp, F	23.5	24.8	28.5
Wind, mph	8 W	Calm	5 W
Room-Air Temperatures at Sitting Level, F			
Living Room East	70.6	72.2	73.1
West	70.4	72.2	73.3
South Bedroom	70.4	72.6	72.6
Bath	72.0	73.5	73.1
North Bedroom	72.0	73.1	72.6
Dining Room	71.6	73.1	73.5
Kitchen	71.8	72.8	72.8
Southwest Basement	67.1	72.8	73.5
Southeast Basement	68.0	74.0	73.8
Maximum Diff			
First Story	1.6	1.3	0.9
House	4.9	1.8	1.2

The temperature difference between rooms on the first story was similar with all systems studied. The temperature difference between the first-story rooms and the basement, based upon data collected at 6:30 a.m., was satisfactory except when the ceiling outlets were used in the basement. It was found with ceiling diffusers that little improvement in temperature balance could be made by increasing the air flow to the basement ducts. Stratification occurred in the basement, and warm air was observed moving up the stairway into the first story.

About 62 percent of the total air flow was delivered to the first story and 38 percent to the basement, except when low inside wall registers were used and 67 percent of the flow was required on the first story. Based upon the calculated heat loss of the two heated spaces and assuming equal register temperatures, the first story would require 67 percent of the total flow and the basement 33 percent. The small differences in the theoretical and actual division of the total flow were attributed to variations in register-air temperatures and vagrant heat gains to the two spaces. It should be noted that the air-flow rates to the first story and basement were the same with the ceiling outlets as with the other supply outlets, even though the temperature difference between floors was greatest with the ceiling outlets. The difference in performance was attributed to the movement of the stratified basement air up the stairway to the first story.

Room-Air Temperature Variations During Cycling of Burner and Blower: Cyclical variations in room-air temperature during continuous blower operation and cyclical burner operation amounted to about 0.4 F deg on the first story and 0.7 F deg in the basement. During periods of high solar intensity in mild weather, the reduction of the first-story heat loss caused cycling of the blower, and the basement-air temperature dropped because the effect of sun on the basement heat loss was comparatively small. Average daily temperatures at the thermostat on the first story and at the 30-in. level in the basement have been plotted in Fig. 5 as a function of average daily outdoor temperature. These data were obtained with floor diffusers. The trends of the curves indicate that the extraneous heat gains (such as sun and cooking) were equal to or greater than the first-story heat loss during mild weather, and that the basement temperature decreased during the periods when burner operation and, consequently, fan operation was not required. The basement temperatures

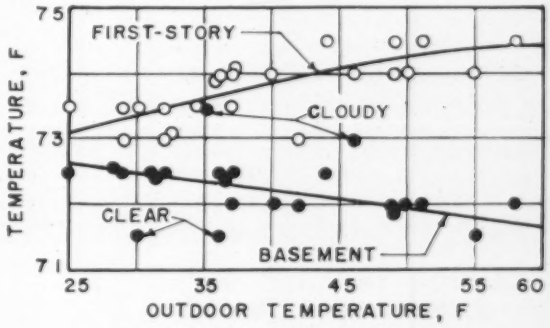


Fig. 5 — Effect of average daily outdoor temperature on average daily room-air temperature at thermostat on first story and at 30-in. level in basement (H 4)

Table 4 Basement-air temperatures at floor (4-in.) and sitting (30-in.) levels

Series	Outdoor Temp, F	Supply Temp, F	Floor Level Temps, F			Sitting Level Temps, F		
			Avg*	Max	Min	Avg*	Max	Min
H 1	9.3	110.0	66.6	67.8	64.3	67.8	68.4	67.3
H 4	17.0	117.0	71.9	72.8	70.0	73.7	74.7	72.8
H 5	33.2	106.0	72.7	77.3	70.4	73.7	74.9	72.8

*Averages are for 73 stations.

dropped to minimum values of 69 F to 70 F in the late afternoon depending upon the outdoor temperature and the length of time that the burner was off. The time at which the basement temperatures recovered to control temperature varied with outdoor conditions. In average weather recovery was complete in the early evening after preparation of the evening meal. In mild weather recovery was not complete until late evening or early morning.

Air Temperature Variation in Basement Room at Sitting and Floor Levels: Floor- and sitting-level air temperatures measured at 73 locations are summarized in Table 4. With the ceiling outlets (Series H 1) the minimum temperatures at both levels occurred beneath the west window and in the exposed corner. Maximum temperatures occurred along the east wall. The average temperature was low for the reasons discussed in the section on temperature balance.

With supply outlets low along the south wall (Series H 4) minimum temperatures were found beneath the west window, and maximum temperatures were found near the east supply outlet. The small difference between maximum and minimum temperatures with the floor diffusers at the end of extended ducts was due to the fact that the primary air did not extend into the room.

Minimum temperatures were found beneath the south and west windows with low sidewall registers at the inside wall (Series H 5). Maximum temperatures occurred near the supply outlets. Comparison of maximum and minimum temperatures at the 4-in. and 30-in. levels with the low inside wall outlets indicates that the supply air had the greatest effect on the temperature distribution at the floor level.

Room-Air Temperature Differentials and Temperature Gradients: The living zone (4-in. to 60-in. level) temperature differentials were satisfactory with all systems studied, being less than 5 F deg at design conditions. Temperature differentials are listed for the 3 outlet groups in Table 5 for 2 indoor-outdoor temperature differences. The smallest living zone differentials were produced by outlets having horizontal discharge at floor level. The larger differentials obtained with the floor diffusers were attributed to the lack of spread of the primary air. As a result, more stratification occurred with these outlets, and the exposed wall was not blanketed with warm air. While the living zone temperature differentials were small with ceiling diffusers, the temperatures were low.

Representative temperature gradients are given in Fig. 6 for the 3 outlet groups at outdoor temperatures in the range from 31.8 F to 33.1 F. The gradients are those measured in the southwest basement. When the supply air was discharged horizontally at the ceiling, stratification occurred and the temperatures above the 60-in. level were high. The movement of this warm air from the basement ceiling into the first story was noticeable, especially during cold weather. The gradient in the living zone was small, but the air temperatures and the floor-surface temperatures were low. The most satisfactory gradient was produced by those outlets discharging the air horizontally along the floor; however, the gradi-

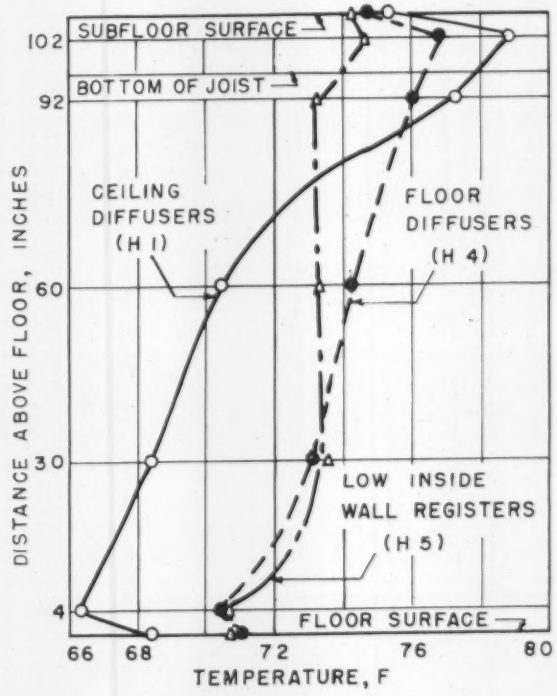


Fig. 6 — Basement-air temperature gradients in southwest basement. With outdoor temperatures from 31 to 33 F at night; with continuous blower operation; wind velocity of 3 to 5 mph, southerly

Table 5 — Average basement-air temperature differentials

Indoor-Outdoor Temp Dif, F	35			70		
Series	H 1	H 4	H 5	H 1	H 4	H 5
	Temperature Differentials, F					
4″ to 30″ Level	1.4	2.7	1.7	2.4	2.8	2.6
4″ to 60″ Level	5.3	4.1	2.2	3.9	4.8	3.1
4″ to 92″ Level	8.6	5.3	2.6	15.2	8.0	3.8

ents with vertical discharge supply outlets were not appreciably larger. The low floor-level air temperatures indicate that heat addition to the concrete slab floor and more complete blanketing of the exposed walls with warm air would be required to improve the gradients.

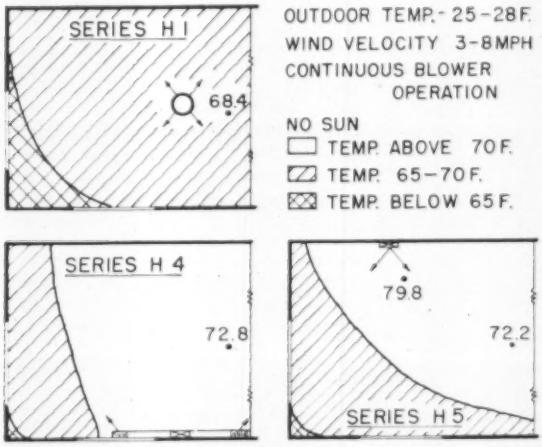


Fig. 7 — Floor-surface temperatures in southwest section of basement

Basement Floor-Surface Temperatures: With each system the basement floor-surface temperatures were nearly independent of outdoor conditions. For example, the daily averages at each of 5 points selected to give a good representation of the different conditions on the basement floor varied less than 3 F deg over the range of weather experienced during each series. Also, the temperatures were approximately constant over any 24-hr period.

Floor-surface temperatures in the southwest basement (approximately one-half of the basement room) are shown in Fig. 7. The temperatures were plotted from 6:30 a.m. temperature readings at 23 stations. The days selected had outdoor temperatures ranging from 24.8 to 28.5 F. The effect of introducing the warm air floor level is evidenced by comparing the temperatures of Series H 1 with those for the other series. The floor-surface temperature near the center of the room in this series was 2 to 5 F deg lower than in the other series, and the floor area shown was at a temperature less than 69 F. With the other systems, from one-half to three-quarters of the floor surface shown was at a temperature above 70 F. The lowest floor-surface temperatures were found in the exposed corner and along the west wall. Although the outlets with horizontal discharge produced the highest floor-surface temperatures in the center, the cool floor area along the west wall was larger than that obtained with the floor diffusers on the extended ducts.

Fuel Consumption

Fuel consumption was less when the ceiling outlets were used (Series H 1) because of the lower temperatures maintained in the basement with these outlets. The highest fuel consumption was observed with the low inside wall registers (Series H 5); however, since the data for this system were collected during mild weather, the data obtained by extrapolation are not conclusive. The increase in fuel consumption resulting from heating the basement may be obtained by comparison of the data for the Series H tests with that for a previous heating season when heat was not added directly to the basement. When the supply outlets were located to supply air at or near the basement floor level, the fuel consumption increased 17 percent over that for the unheated basement at about 0 F outdoors (indoor-outdoor temperature difference = 70 F deg). The increase in fuel consumption over that for the unheated basement amounted to about 8 percent at 0 F outdoors when the ceiling outlets were used.

There was some concern at the beginning of the investigation that placing the partition wall between the 2 halves of the basement would reduce the amount of combustion air available to the furnace, thereby causing poor venting of the furnace with subsequent spillage at the draft hood. A thermocouple grid was placed in the draft hood and the temperature at the grid was recorded during the entire investigation to detect spillage. On the basis of the recorded temperatures and CO_2 content of the flue gas, it may be concluded that the addition of the wall had no measurable effect on the supply of combustion air to the furnace. Infiltration through the three windows in the room in which the furnace was installed and the movement of air beneath the undercut doors separating the 2 basement spaces was apparently sufficient to satisfy the air requirements of the furnace.

Blower Operating Characteristics

The pressure loss on the warm air side of the ceiling supply system was approximately 0.065 in. of water for the total flow rate of 430 cfm. Addition of the extended ducts and floor diffusers at the outside walls caused an increase of about 100 percent in pressure loss on the warm air side. The pressure loss on the warm air

side with the low inside wall registers was 50 percent greater than that in the first series. The increased pressure loss with the inside wall outlets was a result of the increased air flow to the first story required to achieve satisfactory balance with this system. The static pressure loss on the return air side was nearly constant in all series. The total external pressure losses, which ranged from 0.100 to 0.175 in. of water, were less than design values. The increased pressure loss with the Series H 4 and H 5 systems was accompanied by an increase in blower power requirement.

The blower operated approximately 19 hr at an average indoor-outdoor temperature difference of 30 F deg. Continuous operation of the blower occurred at indoor-outdoor temperature differences greater than 50 F deg (23 F outdoor temperature).

Discussion

Outlets with vertical discharge at the outside wall provided highest level of comfort in the basement room. Although the temperature differentials with these outlets were slightly greater than those with horizontal discharge at floor level, the vertical discharge outlets would be favored because they did not cause any localized areas of high temperature or velocity, and they produced the warmest floor. The horizontal discharge outlets at ceiling level were least acceptable because of large floor-to-ceiling temperature variations and cool floors. The outlets having horizontal discharge at floor level caused regions of high temperature and velocity immediately in front of the supply outlets and could cause local drafts. However, in situations where it would be difficult to extend the basement ducts to the outside wall or there would be objection to exposed duct work along the outside wall, the use of low inside wall registers would be recommended. Best results with low inside wall registers will be obtained when the registers are located as close as possible to the floor and when the supply air jet is directed downward upon the floor surface. If the basement room were to be cooled during the summer and outlets with horizontal discharge at floor level were used for heating, some provision for varying the direction of the supply air would be essential.

No difficulty was experienced in obtaining satisfactory room-air temperature balance, based upon 6:30 a.m. temperature data, by adjustment of volume dampers in the branch ducts except in the case of the horizontal discharge at ceiling level. Stratification occurred with these outlets, and little improvement in balance could be obtained by adjustment of the dampers. In this house, room temperature control with a single thermostat was satisfactory on the basis of day-to-day changes in the temperature balance between floors. No large amount of lag or overrun of basement-air temperatures occurred following large variations of outdoor temperature. The need for individual control of the basement temperature was most evident during periods of light load when the first-story heat loss was satisfied by solar heat gains and internal heat loads from cooking. During such periods the burner and blower did not operate and the basement-air temperature decreased to unacceptable levels.

The high room-air velocities, low room-air temperatures, and cool floor surface beneath the window in the west wall of the basement indicate the need for a supply outlet under each window.

Conclusions

1. When heating basement rooms with warm air, the supply outlets should be located to deliver the air at floor level, preferably near the perimeter of the room to blanket the exposed walls and windows with warm air. When outside wall locations are not feasible, the heated air should be delivered from low inside wall locations.

2. Zone control may be desirable when heating a basement room, but the need for it will depend upon the use for which the room is intended and the thermal characteristics of the room. In the room investigated the need for zone control was evident only during mild sunny weather when the burner and, consequently, the blower did not operate.

3. The increase in fuel consumption caused by heating the basement room was less than would be anticipated from the increase in calculated heat loss of the heated space because the basement was normally heated to some degree by vagrant heat losses from furnace casing, smokepipe and ducts. Outlets which delivered the air at floor level required a greater fuel consumption than those that delivered the air at ceiling level, but the space temperatures were also higher.

Acknowledgments

It is expected that these results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the manufacturers who cooperated by furnishing materials and equipment.

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Cooling Tower Design and Performance

By

John Engalitcheff, Jr.

The author is President, Baltimore Aircoil Co., Inc., Baltimore, Md. A presentation at the Symposium on Condensing Methods at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 25, 1958.

THE oldest and most reliable method of conserving water is the use of the evaporative cooling principle. In the older, so-called *Once-Through System*, the heat rejection depends solely on the sensible heat absorbed by the water. Hence, in this type of system, assuming an average heat rejection of 15,000 Btu per hr with a water temperature rise of 20 deg, the water requirements would be 750 lb of water per hr.

In systems using evaporative cooling, the water instead of being thrown away, is recirculated and after being heated, it is brought in contact with air where it is cooled by evaporation. After being cooled, it is recirculated back through the condenser to pick up heat as shown on Fig. 1.

Latent heat of evaporation of water is approximately 1000 Btu per lb. Consequently, to extract 15,000 Btu per hr would require 15 lb of water per hr.

A system using evaporative cooling would theoretically require 1/50, or 2 percent, of the water required by the once-through system. In practice, due to such factors as carry-over and blow-down, evaporative cooling requires approximately 4 to 5 percent of the water that is required by the once-through system.

The oldest method using the evaporative principle for cooling water is a cooling pond. In a cooling pond, the surface of the pond serves as an evaporating surface and air movement is provided by windage.

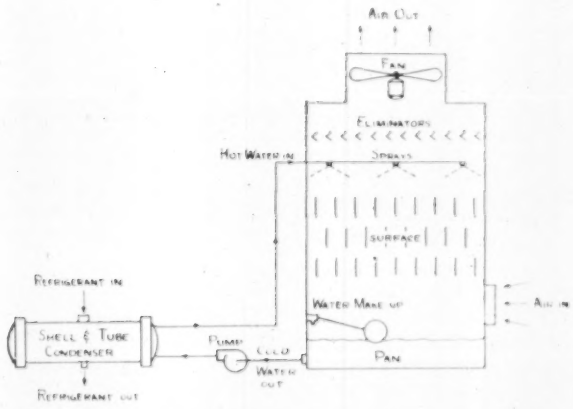


Fig. 1 — Schematic diagram of cooling tower operating with shell and tube condenser

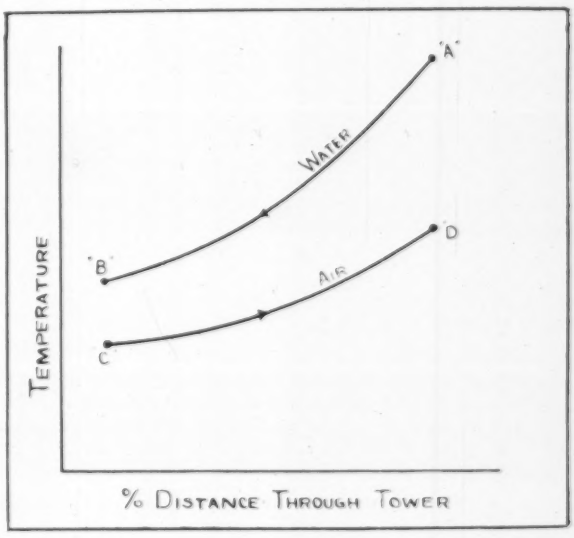


Fig. 2 — Temperature relationship between water and air in a counterflow cooling tower

The present-day cooling tower can be considered as a cooling pond where evaporating or contact surface has been compressed into a very small space and where the air movement is produced by mechanical means. Fig. 2 shows the relationship between water and air as they pass through a counterflow cooling tower.

Without going into details, the air path on the psychrometric chart as it passes through a cooling tower, can be assumed, for this discussion, to be as shown on Fig. 3. This illustrates clearly that the performance of a cooling tower is influenced only by the wet-bulb of the entering air and does not depend on the relative humidity at which the air enters the unit.

Classification of Towers

The present-day mechanical draft cooling towers, from a heat transfer point of view, can be divided into three major classes.

1. *Counter-Flow* — where air moves in an opposite direction to the water (Fig. 4).
2. *Parallel-Flow* — where air moves in the same direction as water (Fig. 5).
3. *Cross-Flow* — where air moves crosswise to movement of water (Fig. 6).

Each of the methods has its advantages and disadvantages, and it is the designer's choice which method to use.

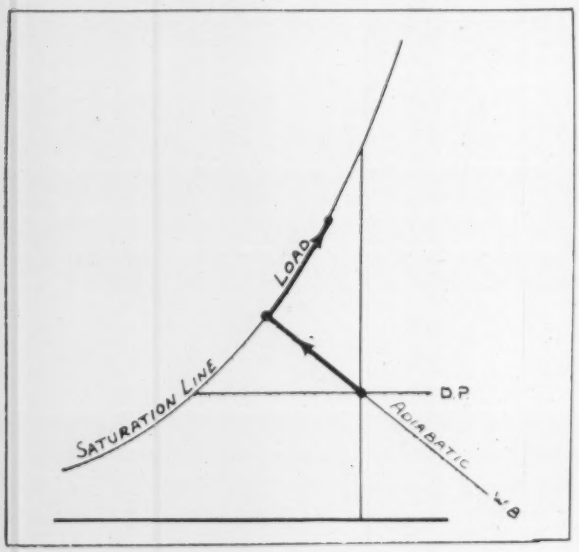


Fig. 3 — Psychrometric air path through a cooling tower

From the user's point of view, so long as the towers are properly designed, any method would be satisfactory. However, each of the methods has its peculiar characteristics, which should be considered in application.

From the water surface point of view, the towers could be divided into three classes.

1. *Deck Filled Towers* in which a surface is produced by distributing water over a physical fill (Fig. 7).
2. *Spray Filled Towers* in which the surface is produced by atomization of water in small particles by discharging it under pressure through atomizing nozzles (Fig. 8).
3. *Combination Spray and Deck Towers* in which the combination of atomization and fixed surface is used (Fig. 9).

From arrangement of mechanical components, the towers could be divided into two classes.

1. *Draw-Through Tower* where air is drawn through, and the fan is located on the outlet of the tower and thus is handling the humidity-laden hot air (Fig. 10).

2. *Blow-Through of Forced Type* where air is pushed through the tower and hence the fan is located on the inlet of the tower and handles relatively dry air (Fig. 11).

Tower Heat Transfer

A cooling tower basically is a very simple piece of equipment, which operates according to the basic heat transfer formula, *i.e.*:

Rate of Transfer = Heat Transfer Coefficient × Transfer Area × Mean Driving Force

or

$$Btu = (t_o - t_i) \times W = K \times S \times MDF$$

where

Btu = the total heat rejected by the tower per unit of time.
t_o = the temperature of water entering.
t_i = the temperature of water leaving.
W = the pounds of water handled per unit of time.
K = the coefficient of heat transfer in Btu's per (square foot) (unit of mean driving force) (unit of time).
S = the total effective heat transfer surface in square feet for the given tower.
MDF = the mean driving force which is the force motivating the heat transfer between water and air.

However, when analyzing cooling tower performance, application of the equation becomes complex, since in the

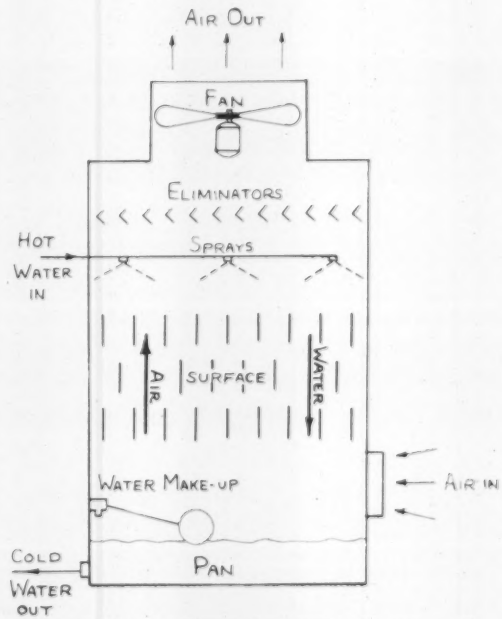


Fig. 4 — Counterflow cooling tower

cooling tower if one factor of the equation is changed it starts a chain reaction, automatically changing other factors. Also another factor complicating the analysis is the difficulty in determining the amount of effective surface

S, as it is comprised of fixed surface as well as the surface offered by the water in fall.

For practical purposes, however, K and S can be treated as a product since for any given tower K as well as S remain constant, and consequently their product will remain constant as well. By *given tower*, is meant a tower which is not only the same in its physical construction, but a tower which handles the same quantities of air and water. As soon as either the water or the air quantities are changed, the tower is no longer the same from the heat transfer point of view.

If that is correct, and if one finds the correct way to figure the *MDF*, then by a single test the product of $K \times S$ can be determined, and hence it becomes possible to analyze and predict the perfomance of any given cooling tower. Also a performance chart† as shown on Fig. 12 can be constructed. This chart applies to counterflow cooling towers and is based on the assumption that *MDF* is a mean enthalpy difference as determined by the Stevens method.

This chart makes it possible to accomplish the following.

1. Select a cooling tower and predict its performance at any other conditions.

2. Evaluate the performance of an installed cooling tower. With one test taken at any operating conditions, it is possible to: (a) determine if the tower is delivering its

†The copyrighted chart is one prepared by A. M. Norris, Member ASHAE, and is used here by permission. A larger scale chart is in existence which permits more ready solution of problems and which also includes a number of worked-out examples illustrating the use of the chart.

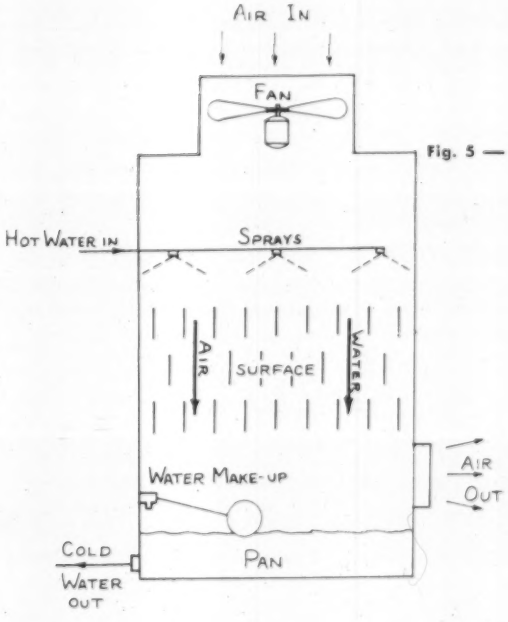


Fig. 5 — Parallel-flow cooling tower

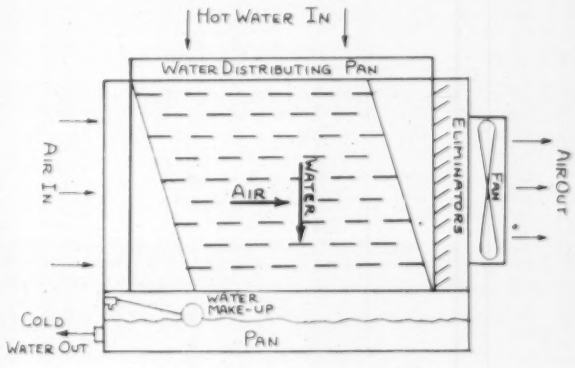
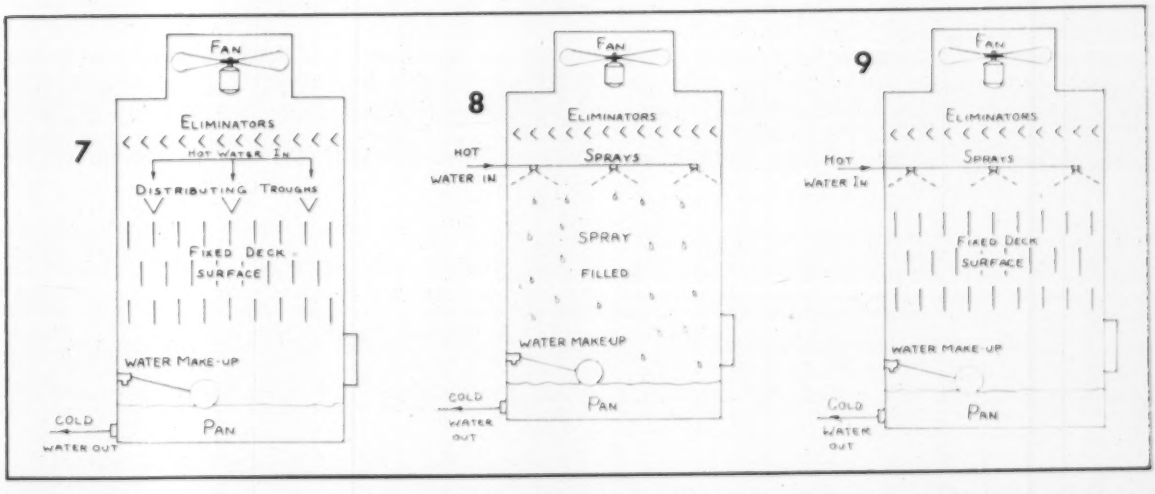
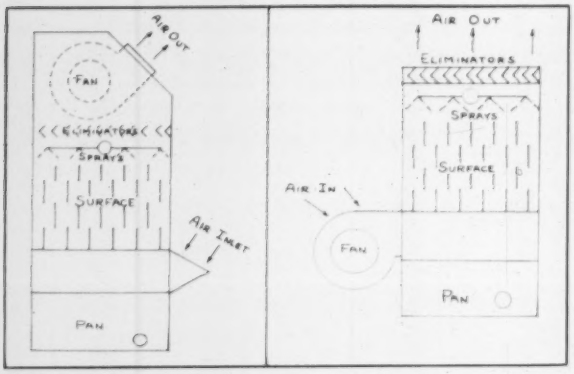


Fig. 6 — Cross-flow cooling tower



Figs. 7, 8 and 9 — Cooling towers have 3 types of water surface arrangement: — deck-filled at 7; spray-filled at 8; combination spray and fixed-deck at 9.



Figs. 10 and 11 — Two kinds of cooling towers classified by mechanical arrangements — draw-through at 10 (left); blow-through at 11 (right).

selected capacity, and (b) predict the tower's performance at any other operating conditions.

The Nature of the Chart

The chart is composed of three sections:—An *Approach Section, Capacity Multiplier Factor Section* and a *Wet-Bulb Correction Section.*

The capacity multiplier factor section is drawn for ranges *vs.* 78 F wet-bulb as base. The approach section is drawn for approaches *vs.* 10 deg range as base. Consequently, when range is other than 10 deg and the wet-bulb is other than 78 F, correction is necessary which is affected by wet-bulb correction section.

Performance Lines in the capacity multiplier factor section indicate how a specific tower would operate under varying load conditions when air and water quantities remain constant. Actually the curves show operating conditions at which a given tower would come to balance under a given load. These same curves become percent efficiency curves when the tower is supplied with 3 gpm per ton of its basic rating.

In analyzing this chart, it can be seen that it is in reality an *MDF* chart, or more correctly, a relationship of *MDF* under given conditions to any *MDF* under base conditions for a tower with constant product of $K \times S$. It was agreed that product $K \times S$ stayed constant for any given tower

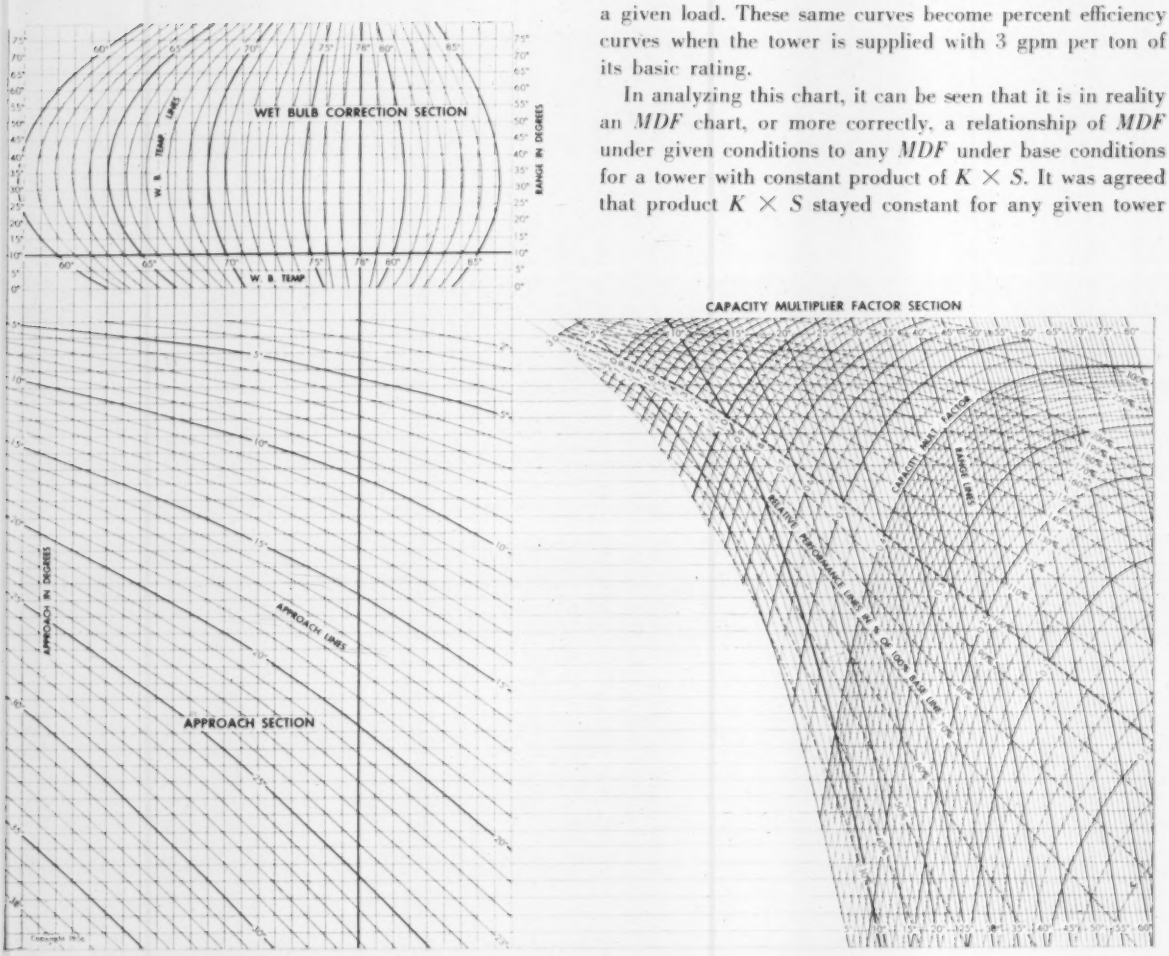


Fig. 12 — Chart for use in selecting counterflow cooling towers and for determining their performance

provided the air and water quantities stayed constant. Now, consider the effect on the capacity of the tower.

First, assume that water quantity, hence S, stays constant, and the only factor that would be subject to change is the air quantity.

It is a common assumption that K varies as 0.6 power of mass velocity. However, as the velocity increases, it increases the air quantity with a corresponding increase in and the product $K \times S$ does not increase as much as with fixed surface.

All factors and their influence considered so far, could be obtained by mathematical calculations. However, in determining the $K \times S$ of a tower, no before-prediction or calculation is possible. The only safe way to arrive at any reliable answer is to run actual tests on the arrangement to be used.

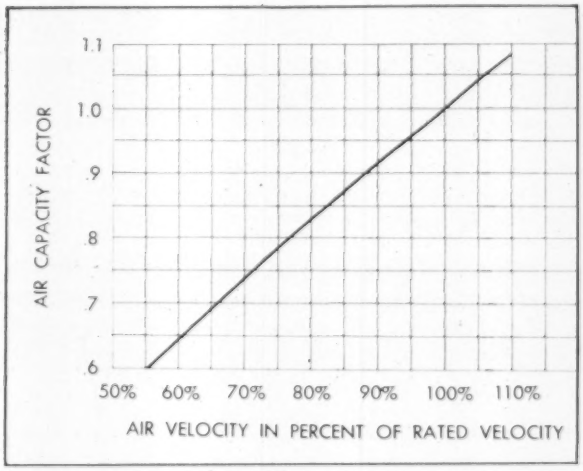


Fig. 13 — Relation between air velocity and cooling tower capacity

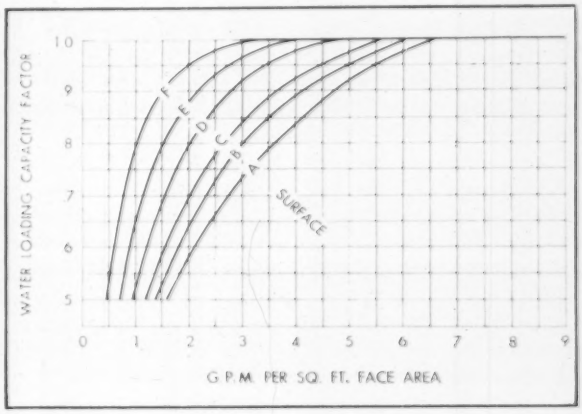


Fig. 14 — Effect of water loading on cooling tower capacity

MDF. The result is that the change in air velocity will change the capacity as the product of the change of *MDF* and K.

Thus, the overall change in capacity in percent *vs.* the change in percent of velocity, is drawn on the curve, Fig. 13, giving the correction factors due to the change in velocity. This relationship seems to apply to any conventional type counterflow tower.

On spray-filled towers, with no fixed surface, it was found that variations in velocity had a much smaller effect on capacity. What appears to happen (in a spray-filled tower) is that as the air velocity is increased, the force of air drives the particles of water together merging them into larger drops. The heat transfer surface is thus decreased

From tests it was found that the overall capacity of the unit varied with the water loading. The effect of the change of water loading being somewhat different for different types and heights of surface. Fig. 14 shows the effect of different water loadings on the capacity of the tower for different depths of the particular surface tested.

In using the chart, it must be recognized and remembered that the selection and performance chart is constructed around one focal point of a unit which extracts 15,000 Btu when supplied with 3 gpm of water and will cool water from 95 F to 85 F with 78 F wet-bulb air. This unit is taken as the *unit of measure* and everything in the chart is expressed in multiples of this unit.

Also, it must be remembered that when the air is held constant, and when the water rate is constant and only the load is changed, the tower will perform along a *Performance Line*.

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Vapor Problems in Thermal Insulation

By

N. B. Hutcheon

The author is Assistant Director, Division of Building Research, National Research Council, Ottawa, Ont., Canada. A presentation at the Symposium on Thermal Insulation at the Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Minneapolis, Minn., June 24, 1958.

There are many problems associated with water vapor and its migration within building constructions, and a great many of these are related to the use of thermal insulation. Many people in the insulation industry seem reluctant to admit that the use of insulation creates any problems but the simple fact is that thermal insulation applied to a construction results in increased temperatures on the warm, or high temperature, side, and decreased temperatures on the cold, or low temperature, side. This is the inevitable result if the insulation does its job. Any tendency to condensation on the warm side is thereby decreased by the application of insulation and in fact the insulation is frequently used to create this situation and thus to reduce or eliminate condensation of water vapor at these parts of a construction. However, if the vapor density on the warm side is high enough, and if the wall does not provide sufficient resistance to the flow of vapor, migration of vapor through the construction to colder layers on the low temperature side of the insulation can occur. If the density of vapor thus provided at any plane within a construction tends toward a dew-point temperature higher than the temperature at that plane, condensation and subsequent wetting can occur.

It will be assumed that the mechanism of condensation, and the undesirable effects which it can produce are well recognized and need no detailed discussion. The severity of the problems created is, in general, proportional to the rate at which liquid water is formed on or in a construction. It is of interest to note a special feature of the problems associated with condensation formed at temperatures below freezing. The condensate (or sublimate) in such cases is not liquid, but accumulates as frost or as ice. These accumulations in themselves do not always create serious problems, but upon a rise in temperature, melt and thus release over a relatively short time the total weight of water substance which may have been accumulating since the last time the temperature was above freezing. This storage effect at low temperatures gives rise to problems in insulated constructions exposed to prolonged cold weather conditions, even though the rate of condensation is not great and, if occurring at temperatures above freezing, might be tolerated within the construction.

Principles of Vapor Control

The general principles by which condensation within insulated constructions can be controlled have been known and increasingly recognized since 1937 when Rowley, at the University of Minnesota, conducted his outstanding experiments with vapor barriers. These are, to *reduce the amount of water vapor which can enter a construction on the side of higher temperature*, and to *facilitate the escape, on the side of lower temperature, of the water vapor which does enter the construction.*

The entry of vapor at the warm side can be reduced by reducing the density of the vapor to which the construction is exposed at the warm side, or to incorporate within the construction on the warm side of the insulation materials providing resistance to the passage of water vapor. Materials providing high resistance to vapor flow and used primarily for this purpose are called vapor barriers.

Escape of vapor from a construction once it has entered can be facilitated by selecting for the materials on the cold side of the insulation only those which will pass vapor relatively freely. A second, and equally important way is by providing suitable openings by which the vapor which has entered the wall can escape either through or around the parts of the construction which resist its escape to the cold side. Such openings are used to provide a means of escape by diffusion of the water vapor by itself but more frequently they must be arranged to allow air to enter, which will absorb the water vapor and carry it off to the cold side. Such ventilation must be provided only by air drawn from and returned to the cold side, and not by air drawn from the warm side of the construction.

These principles are being applied successfully and without great difficulty to the majority of the cases in which vapor problems in thermal insulation are likely to arise. The difficulties which remain to be overcome are in the development of accurate means of predicting vapor flow and condensation, and in finding suitable ways of dealing with a substantial number of situations in which other requirements make the application of these principles difficult or impossible.

Transport of Vapor by Air Leakage

One of the possibilities for entry of water vapor into the warm side of a construction, and its transport to a cold surface, is frequently overlooked. Although the main mechanism of vapor migration is usually regarded as a diffusion, any substantial movement of air is likely to carry vapor along with it. Normal air pressure differences occurring as

a result of *chimney action* and wind can cause air to stream through cracks and openings, and to transport water vapor through them at a rate many times that which can occur by diffusion alone. The net result so far as condensation is concerned may be the same as that which would result from a greatly increased diffusion through the materials on the warm side. This effect is analogous to that produced in the case of heat flow by infiltration and by convection, as distinct from conduction. Improperly sealed access doors leading to attics will allow the passage of water vapor along with the upward air leakage at rates capable of producing serious attic condensation. Constructions finished with plaster on the warm side are usually quite air-tight but some dry wall finishes with unfilled joints and with corresponding gaping joints in the vapor barrier will allow sufficient air-and-vapor leakage to cause very serious condensation troubles.

Prediction of Vapor Flow Rates

The calculation of vapor flow by diffusion is usually made on the basis of a simple flow equation based on Fick's law:

$$w = -\mu dp/dx$$

where

w = flow rate.
μ = coefficient of vapor permeability.
dp/dx = vapor pressure gradient.

This equation is analogous to that used in the calculation of heat transmission $q = -k\ dt/dx$ and vapor flow calculations can be made in an entirely comparable manner. The permeability coefficient can be established from suitable tests, as is the coefficient of thermal conductivity in the case of heat flow. However, there is one important difference of great practical importance. The permeability coefficient, μ, unlike k, is not a constant for any given material but can be greatly influenced, in a complicated way, by temperature and vapor pressure.

Despite the great difficulties inherent in dealing rationally with moisture migration over the full range of conditions likely to be encountered, many useful calculations may be made on the basis of the simple flow theory. The permeability coefficient is reasonably constant for a few materials and for many others it does not vary widely over a range of conditions resulting in low or moderate relative humidities. Useful results can be obtained in many cases by the judicious use of coefficients obtained from relatively simple dry and wet cup tests. These tests can also be used as a basis for a useful comparison of the moisture transmission characteristics of materials, and they have for some time been successfully employed as a basis for selecting vapor barrier materials.

Criteria for Vapor Barriers

Calculations made independently a number of years ago by Miller and by Babbitt indicated that for certain insulated wood frame constructions exposed to severe winter conditions, with moderate humidities carried on the warm side, additional resistance by way of a vapor barrier was required on the warm side of the insulation in order to prevent serious condensation. They were able to establish also that this vapor barrier should not pass more than about 0.7 grains of moisture per (sq ft) (hr) (in.) of mercury, (permeance 0.7 perms) when tested under certain conditions.

In the United States *HHFA* has set a limit of 1 perm for vapor barrier materials, and these materials as installed must meet a limiting permeance of 1¼ perms. In Canada a limit of 0.75 perms for vapor barriers has been widely used and has proved to be satisfactory in practice, even under severe winter conditions. No Canadian cases are known in which a vapor barrier meeting this requirement and properly installed with lapped and clamped joints in insulated wood frame walls of average construction in dwellings has failed to give adequate control over vapor flow under winter conditions. Canadian experience has indicated the desirability of avoiding any membranes on the cold side which have an effective permeance less than 3 perms, and the value of using separate and continuous vapor barrier membranes even when vapor resistant membranes are provided with the insulating batt or blanket.

Moisture Storage an Advantage

Joy was the first to point out an important factor in condensation control, the ability of the sheathing material to sorb and to store water. With a 0.75 perm vapor barrier in insulated wood frame dwelling construction, the moisture entering the wall in one winter season will be about 0.1 pounds per sq ft. This amount of water can be taken up by 1-in. wood sheathing with a rise in moisture content of only 3 percent, to be given off under more favorable escape conditions the following summer. Constructions possessing this feature may be particularly desirable under severe and prolonged winter conditions when diffusion through the outer covering is greatly reduced as a result of lowered temperatures, and there is a tendency for condensation to be collected over long periods as frost or ice.

Cold Storage Construction

The general principles of vapor control already outlined apply also to low temperature storage constructions. They differ from heated buildings mainly in the direction of vapor flow which is inward, requiring that the vapor barrier be placed on the outside, and in the long periods of

continuous operation over which moisture entering the construction can accumulate. The selection of vapor barriers likely to provide very low permeance and good durability will usually be justified.

Reversed Flow Conditions

Special problems in vapor control can arise in cases in which there is a reversal of vapor pressure gradient, and therefore of the direction of vapor flow, on a cyclical basis. Cool-storage buildings operating at temperatures of about 40 F experience such reversals in vapor flow from winter to summer, and pose an awkward problem since the vapor barrier ought to be on the outside in summer and the inside in winter. Attempts to seal a wall construction by vapor barriers on both sides will seldom be fully effective since the barriers can never be perfect and the air between them, expanding and contracting from winter to summer to winter, causes a breathing action which may result in some accumulation of moisture. In special cases vents provided on both sides of a wall may be alternately opened and closed from season to season. Unless the reversal is particularly severe, a single vapor barrier may be located for the more severe condition with some condensation in the opposite season being accepted.

Special Problems in Metal Buildings

Serious condensation problems have been experienced in many metal buildings insulated and heated for winter occupancy. Metal ribs often provide heat paths through the insulation, producing surface condensation. Interior finishes and vapor barriers are frequently installed so as to permit excessive outward leakage of warm moist air. The exterior metal skins restrict the outward diffusion of any vapor which does enter the construction and are incapable of storing any moisture which may collect. Difficulties can be eliminated by careful design and installation.

Insulated Roof Problems

By far the most important building moisture problem economically is that encountered in roofs consisting of impermeable coverings laid over insulation on flat decks or slabs. The roof covering is, for all practical purposes, a perfect vapor barrier and effectively traps any moisture which is present at the time of construction or which subsequently enters the insulation as vapor from inside the building. Since air trapped between the vapor barrier and the roof covering will undergo substantial pressure changes as a result of daily or seasonal temperature changes, or even as a result of alternate sunshine and rain in summer, it is seldom possible to prevent breathing of the space occupied by the insulation. This action should be recognized and provision made for it by way of vents to the outside, properly shielded against entry of rain and snow. Good vapor barriers are essential for proper protection of insulation and roofing in the case of any moderate- or high-humidity occupancy.

Conclusion

Control of the flow of water vapor so as to avoid condensation can be achieved without great difficulty in many applications of thermal insulation. Such control is needed for the proper functioning of thermal insulation and in order to avoid excessive deterioration of the adjacent construction as a result of wetting. The principles and practice are now well established for many situations but there are some which present special difficulties. Moisture migration within materials and particularly the way in which this is related to temperature gradient and to heat flow require a great deal of further study and research before any great refinement in the prediction of moisture conditions within building constructions can be achieved.

TI

Bulletin on THERMAL INSULATION

If there is sufficient interest it is likely that a Special Bulletin, to contain the 5 papers presented at the Symposium on THERMAL INSULATION at the Semi-Annual Meeting, June 24, 1958, will be prepared as a service to members. In order to assist in the decision please indicate your needs in connection with such a bulletin.

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Evaporative Condensers

By

D. D. Wile

The author is Vice President and Chief Engineer, Recold Corp., Los Angeles, Calif. A presentation at the Symposium on Condensing Methods at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Minneapolis, Minn., June 25, 1958.

ALTHOUGH the evaporative condenser is of fairly modern vintage so far as its use in refrigeration and air conditioning goes, its true origin appears to be lost in the claims of many individuals and various sections of the country. There are still those in the West who claim to have been the first to install a condensing coil in the sump of a cooling tower for the purpose of reducing head pressure during very hot weather. And one can find those in the East who, inspired by the principle of the Baudelot cooler, claim to be the first to have trickled water over bare condensing coils.

Regardless of the legitimacy of its origin, the evaporative condenser is a lusty contender in the condenser field. It continues to grow and prosper in the face of competition from the long-established cooling towers and the more recent air-cooled condensers. The size of evaporative condensers, available as factory-assembled units, has steadily increased over the years. Today they are available in sizes ranging from 2 to well over 250 tons in a single unit. Multiple-unit installations are competing with large cooling tower applications.

Types of Evaporative Condensers

As shown in Fig. 1 the evaporative condenser consists essentially of a bare tube condensing coil, sprayed with water and cooled by a flow of air that evaporates some of the water. Eliminators are placed in the outlet of the unit to prevent the *drift* or escape of water particles in the discharge air stream. There are two general types, the draw-through type as shown in Fig. 1 and the blow-through type as shown in Fig. 2. The blow-through type places the fans, shaft and bearings in the inlet air stream rather than in the warm, nearly saturated discharge air. Rusting and deterioration of these parts is thus reduced. Furthermore, with the draw-through arrangement, if eliminators are less than perfect, there is an opportunity for scale to form on blowers or fans. This tendency is eliminated by the blow-through arrangement.

Effective Bleed is Essential

An evaporative condenser evaporates approximately 1.8 gallons of water per hour per ton of refrigeration capacity. Impurities in the water supply are left behind in the recirculating system. Unless corrective measures are applied, continued operation causes serious concentration of impurities and rapid scale formation. Water treatment does not remove impurities, it only converts them into a more soluble form. It thus is necessary to waste or *bleed* off a portion of the recirculated water in order to hold the concentration of impurities to a reasonable level. A conventional method of bleed is by a small tube, shown in Fig. 1, connecting from the pump discharge to the drain. It is essential in this arrangement that the tube be of the proper diameter and length to suit the bleed requirements of the particular size condenser. Fig. 2 shows a patented arrangement of a funnel on top of the overflow tube with diameter selected to catch the desired amount of drip from the coil and divert it, without danger of clogging, to drain.

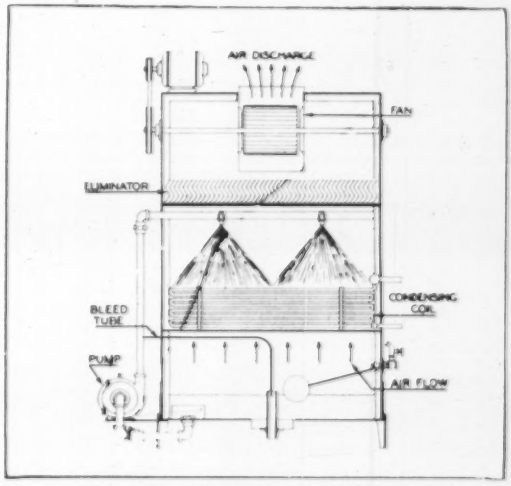

Fig. 1 — Draw-through type evaporative condenser has fan in the discharge air stream

The amount of bleed is usually varied with the hardness of the water, the type of treatment (if any) and to some extent with the cost and availability of water but generally runs from a minimum of one-half the evaporation rate to a maximum of one or two times the evaporation rate. Thus the total water consumption will run in the range of 2½ to 5 gallons per hour per ton and is generally less than 5 percent of the *once through* or waste water condenser.

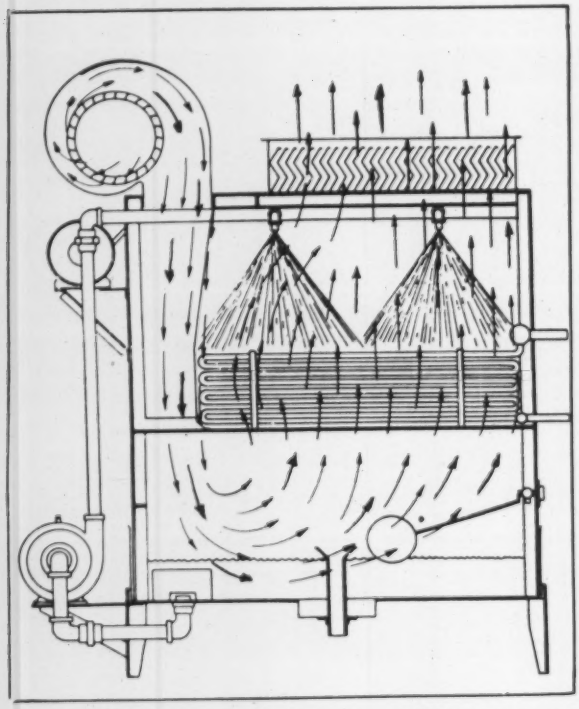

Fig. 2 — Blow-through type evaporative condenser has fan in the inlet air stream. Funnel on overflow tube diverts or *bleeds* proper amount of water to drain

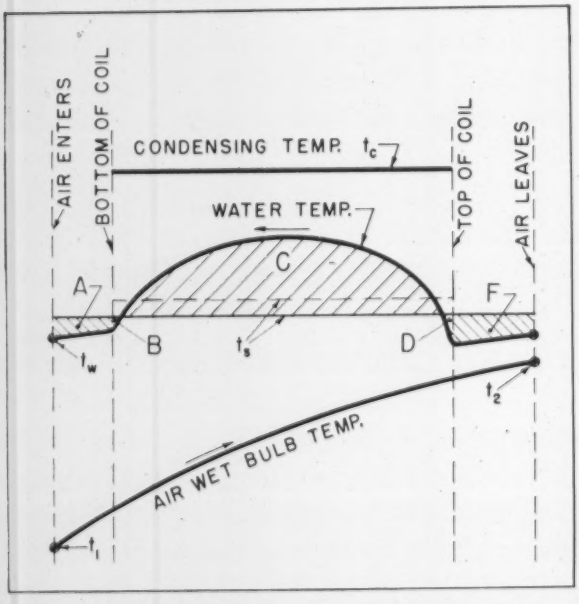

Fig. 3 — Water circulating in the evaporative condenser goes through a complex cycle of temperature changes that makes analysis of the heat transfer process difficult

Effect of Scale Deposit

While much has been said about the disadvantages of scale formation in the evaporative condenser, there has been too little said about the ability of these units to continue satisfactory operation even with a considerable amount of scale deposit. The evaporative condenser has inherently low heat transfer rate from the coil surface to air. A fairly thick film of scale has little affect on the overall heat transfer coefficient. It is only when scale forms thick enough to affect air flow that capacity is seriously reduced.

Most of the *horrible examples* of evaporative condenser troubles are based upon exceptionally bad installations or improperly designed equipment. A properly designed evaporative condenser provided with a dependable bleed arrangement will operate for years with minimum attention. It is not at all uncommon, even in areas of fairly bad water, for evaporative condensers without water treatment to operate for 5 years or more with no cleaning of scale from the tubes. By comparison a condenser operating with inadequate bleed can become inoperative in only a few weeks due to excessive scale formation.

Heat Transfer Analysis

The heat transfer process of the evaporative condenser is a combination of sensible and mass transfer that is further complicated by a complex temperature pattern of the water flowing over the tubes. A general idea of the variations in temperature of the recirculated water is given in Fig. 3 where air flow is represented from left to right and water flow from right to left. The water temperature, leaving the spray nozzles (far right), drops slightly on passing through the area above the coil, then rises sharply as it contacts the warm tubes and again decreases in temperature towards the bottom of the tube bundle, with a slight further decrease while dropping through the air stream between the bottom of the coil and the sump pan. Numerous authors[1, 2, 3, 4] have proposed methods for analyzing evaporative condenser performance data, yet no method of analysis has general acceptance in the industry today. Too often condensers are designed by rule of thumb and judged solely on the square feet of coil surface with complete disregard for the many other factors which have an important bearing on performance such as water and air circulation.

One method of analysis that has been successfully used by the writer[3] to analyze test data on evaporative condenser performance is shown in Fig. 4 where heat transfer from the refrigerant, inside the tubes, to the surface of the water film is represented by a conventional heat transfer coefficient while heat and mass transfer from the water film to the air is expressed by a bypass factor. The method has shown consistent results when applied to test data from a wide variety of condenser sizes and operating conditions.

[1] Exponent numerals refer to References

Winter Control Methods

On many types of refrigeration and air-conditioning systems it becomes necessary to prevent excessively low head pressure during cool weather operation and thus some method of modulating condenser capacity is required.

1. Cycling fan and pump motors simultaneously, under the control of a pressure switch, is satisfactory for many applications but may be undesirable on others due to excessively wide fluctuation of head pressure.

2. Cycling of the pump motor is undesirable because repeated wetting and drying of the condenser coil tends to accelerate scale formation.

3. Cycling the fan motor may cause complications in some installations. With the fan stopped, air flow may be induced by the sprays in opposite to normal direction.

4. Modulating dampers, generally located at the fan discharge, have proven convenient and entirely satisfactory. The damper motor is generally controlled from the recirculated water temperature. This method also provides a satisfactory non-freeze control for winter operation when augmented by a small heater in the sump or by an auxiliary sump located in a heated space below the condenser as shown in Fig. 5.

Desuperheating Coils

Air generally leaves the evaporative condenser, as indicated by the psychrometric diagram in Fig. 6, at a lower dry-bulb temperature than the entering air. A coil placed in this air stream thus becomes an effective addition to the condenser capacity especially if the superheated gas from the compressor enters this coil first. Fig. 7 shows an evaporative condenser with a desuperheating coil installed on the air outlet. It has been claimed by some that a desuperheating coil reduces scale formation but there has been no adequate proof of this claim. The desuperheat coil, in the opinion of the writer is simply a convenient method of increasing the capacity of an evaporative condenser in a more economical manner than going to the next larger size unit. It will also improve the efficiency of an oil separator—particularly important on ammonia systems.

System Performance

As a manufacturer of the three types of water conserving equipment, the writer believes that evaporative condensers, cooling towers and air-cooled condensers each have their proper place. The air-cooled condenser requires minimum service but has the disadvantage of higher initial cost even when selected on 115 F condensing temperature as compared to 105 F for a tower or evaporative condenser. The air-cooled condenser will also have higher operating costs due to the higher condensing pressure and generally larger fan motor as compared to the combined fan motor and pump of the evaporative condenser. This is especially true when the air-cooled condenser is equipped with a *winter control* for preventing low head pressure during cold weather.

Condensers are generally selected on the basis of summer design conditions, but the refrigeration system must

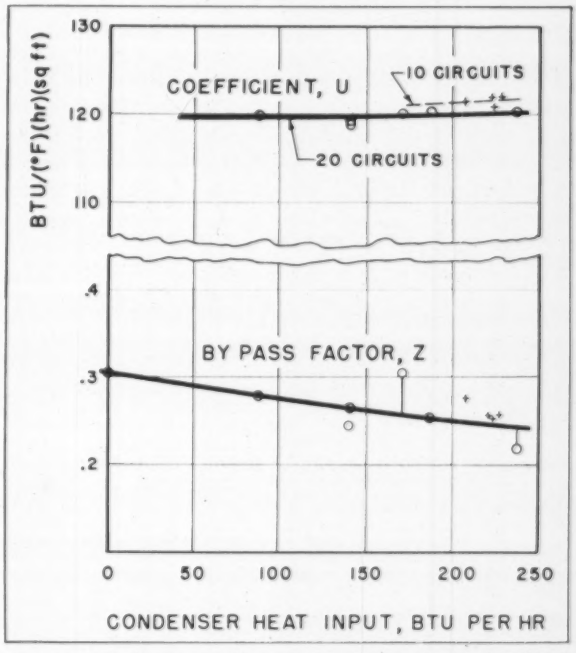

Fig. 4 — Performance of an evaporative condenser is difficult to analyze. This method uses a conventional heat transfer coefficient from refrigerant to wetted surface and a bypass factor from wetted surface to air

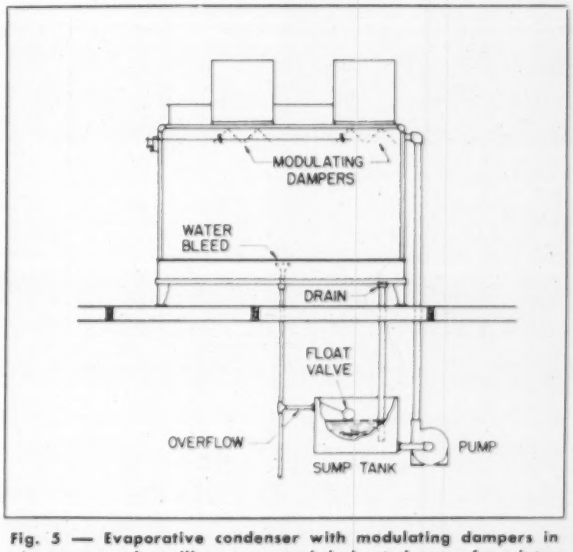

Fig. 5 — Evaporative condenser with modulating dampers in air stream and auxiliary sump tank in heated space for winter operation. Dampers are controlled from spray water temperature

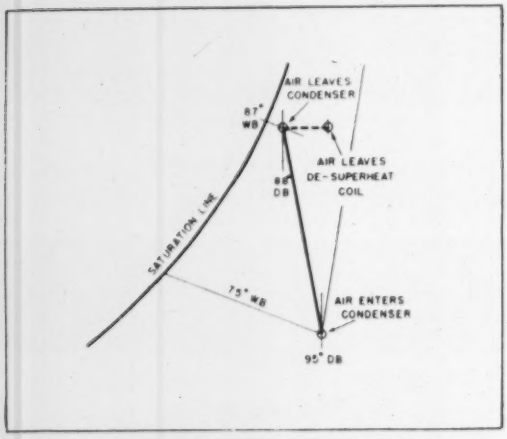

Fig. 6 — The dry-bulb temperature of air leaving the evaporative condenser is usually lower than that at which it enters due to evaporative cooling

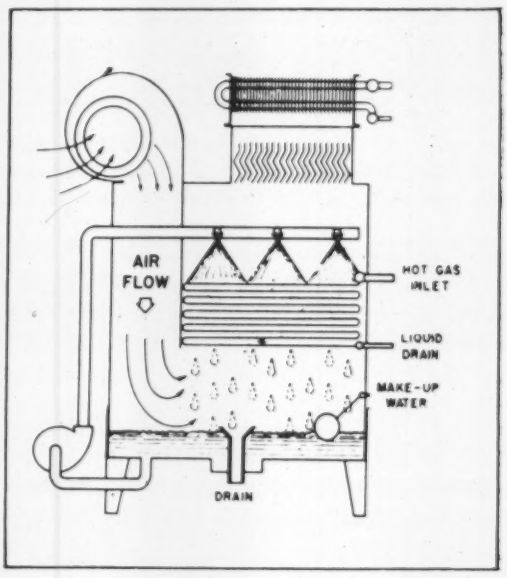

Fig. 7 *(right)* — A desuperheating coil mounted on the discharge of an evaporative condenser provides an economical way of increasing capacity

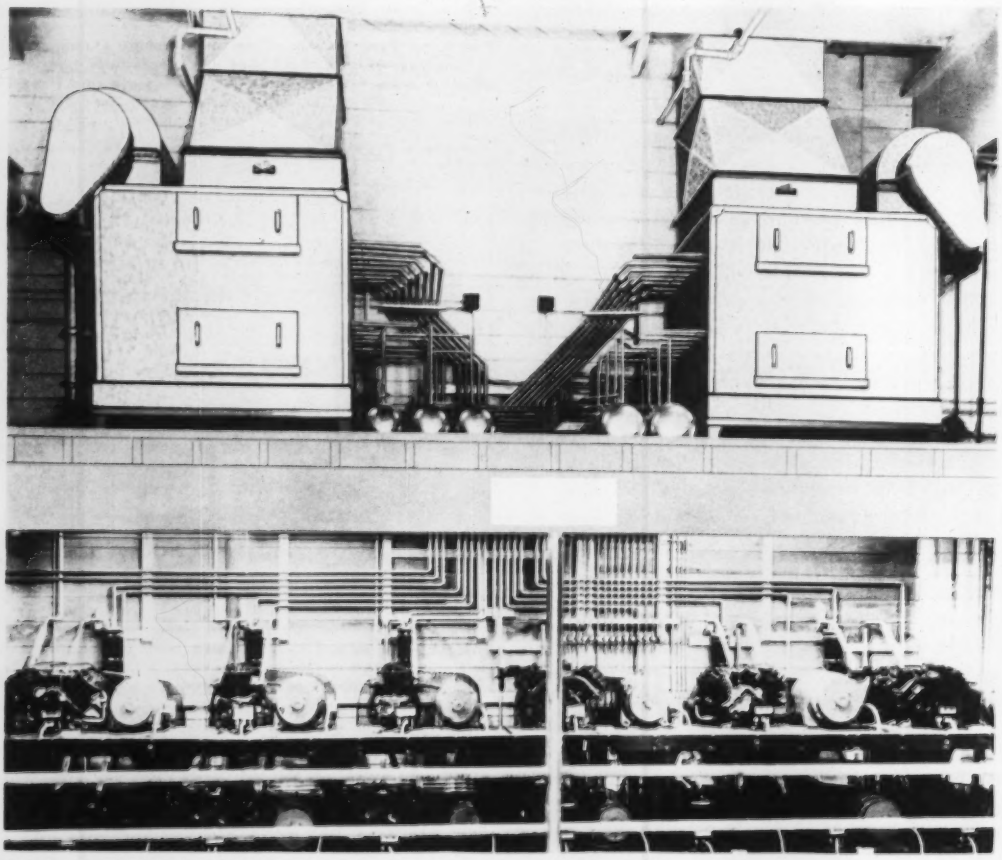

Fig. 8 — Evaporative condensers are frequently constructed with multiple circuits. This installation has 15 circuits with 4 spares for future additions

continue operation during maximum temperature days. On extreme temperature days the wet-bulb temperature rises only a few degrees above *design* as compared to a 10 to 20 deg rise in the dry-bulb temperature.

A typical example is an evaporative condenser selected for 105 F condensing temperature at 78 F design wet-bulb and the air-cooled condenser selected for 115 F condensing temperature at 95 F design dry-bulb. On extreme temperature days the condensing temperature may go as high as 108 F with the evaporative condenser and will go at least to 125 F with an air-cooled condenser. Condensing pressures with refrigerant 12 will then rise to 134 and 168 psig respectively. Thus evaporative condensers require little or no oversizing of compressor motors in contrast to the requirements for air-cooled condensers.

In addition to the rise in condensing pressure, during extreme conditions, there is a considerable rise in the discharge gas temperature, which may accelerate deterioration of oil and reduce compressor life. This more difficult operating condition for the compressor, under peak load, must be taken into account when considering the over-all service requirements of the system.

Multiple-Circuit Condensers

Evaporative condensers are now available with the condensing coil divided into multiple circuits. Fig. 8 is an example of an evaporative condenser installation in a super-market handling a number of refrigeration circuits along with the air-conditioning compressors. These condensers insure efficient operation of the refrigeration and air-conditioning equipment throughout the entire year with only moderate service requirements.

References

1. Evaporative Condensers — Theory and Characteristics, by William Goodman (*Heating, Piping & Air Conditioning*, March 1938, p. 165; April 1938, p. 258; May 1938, p. 327).

2. Heat Transfer in Evaporative Condensers, by E. G. Thomsen (*Refrigerating Engineering*, Vol. 51, No. 5, May 1946, p. 435).

3. Study of Heat Transfer in Unit Refrigerant Condensers Which Use Evaporative Cooling (*Refrigerating Engineering*, Vol. 33, No. 3, March 1939, p. 69).

4. Heat Transmission in Evaporative Condensers, by A. K. G. Thompson (*Engineering*, Vol. 149, No. 3871, March 1940, p. 149).

5. Evaporative Condenser Performance Factors, by D. D. Wile (*Refrigerating Engineering*, Vol. 58, No. 1, January 1950).

HOUSES WITHOUT BASEMENTS

A publication in Swedish reports studies made on houses without basements with special reference to foundations.

In Scandinavia, the danger involved in frost effects is one of the most important problems to be solved in connection with the construction of houses without basements. To build houses without basements is economically justified only on condition that the depths of foundation stipulated in the official regulations can be considerably reduced. Other problems met with in this connection concern the room temperature, the heat losses from a building to the soil, and the effects of moisture. These problems are bound up with questions relating to various heating systems, concrete slabs resting on the ground and crawl space designs.

The book in which the study is reported covers the factors which influence the frost heave, such as the heat balance and the moisture content of the upper soil layers, the constant soil temperature, and the various types of soils. Furthermore, it outlines a method which has been evolved for calculating the quantities of heat given off from a building to the soil. It contains also an account of an investigation dealing with the inside temperatures in houses provided with various types of floor structures and different heating systems.

A large number of Swedish and foreign floor structure designs are described, and are discussed on the basis of the results obtained from this investigation. Recommendations are given for choosing appropriate principles of design under various conditions.

While the text of the book is in Swedish it is understandable to those who do not read anything but English, since there is a table of contents and a summary in English and the captions to all figures and illustrations throughout the book have English translations. The price of the book is 9 kronen and the publisher is AB Tidskriften Byggmastaren, Stockholm.

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gifts to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Fourier Series and Boundary Value Problems, by Churchill (1941). Gift of A. N. Cerny, ASHAE Laboratory Staff.

Heat and Thermodynamics, by J. K. Roberts and A. R. Miller (1954, 4th Edition). Gift of A. N. Cerny, ASHAE Laboratory Staff.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

ASHAE-*ASRE* Joint Sessions and Functions Highlight Minneapolis Meeting

With both Societies meeting concurrently there was a wide choice of sessions to attend. Altogether there were 4 joint sessions, 2 arranged by each Society. ASHAE held 5 technical sessions, 2 of which were Symposia. Joint social and special events enhanced the Semi-Annual Meeting

The 1958 Semi-Annual Meeting was marked by numerous unusual features. One of these was that it was held concurrently with the 54th Annual Meeting of *ASRE*, and there were joint sessions of both societies. This permitted a wider choice of sessions to attend than usual. There were numerous inspection trips, a jointly scheduled ladies' trip to the famous Betty Crocker Kitchens, and a full program for the children. A trip on a special train to a County Fair outside the city of Minneapolis was a most unusual event, after which both societies united to hold a single joint dinner.

In addition to the joint events, each program retained most of the established functions, such as golf competitions open to members and guests, committee meetings, conferences, and forum discussion groups, as well as technical sessions with formally prepared papers.

The ASHAE program was made up of 5 sessions all held at the Pick-Nicollet Hotel in Minneapolis. There was a single session on Monday, June 23, and concurrent sessions on Tuesday and Wednesday mornings, June 24 and 25. Two of these 5 sessions were of the symposium type and both of these were joint with *ASRE*. A total of 9 technical papers were presented and discussed.

The *ASRE* program included a general assembly, 3 technical sessions, numerous discussion groups and forums. Programmed also were 2 joint conferences with ASHAE, one of these being on air conditioning and the other being on education. The *ASRE* program also was held on the 3 days, June 23, 24 and 25, at the Hotel Leamington in Minneapolis.

With the incentive of the 2 concurrent meetings, many were attracted to Minneapolis. A summary of the registration figures shows that 384 members, 67 guests, 123 ladies, and 27 children attended.

Each society had the benefit of the efforts of its own Committee on Arrangements, and the success of the meetings was largely due to the work of these committees.

As the head of the ASHAE Committee on Arrangements, J. S. Locke served as general chairman. John E. Haines and F. B. Rowley were honorary chairmen, while G. M. Kendrick and J. F. Siegel served as vice chairmen. Assisting them and contributing greatly were the following sub-committee chairmen: *Banquet* — L. C. Gross; *Children* — R. M. Jack; *Entertainment* — J. L. Hanson; *Finance* — V. E. Pearson; *Ladies* — S. L. Furber; *Publicity* — W. J. Ortman; *Reception* — M. S. Wunderlich; *Sessions* — William Sturm; *Sports* — B. F. McLouth; *Transportation* — J. A. Craig.

MINNEAPOLIS MAYOR SPEAKER AT OPENING LUNCHEON

The Welcome Luncheon on Monday noon was enlivened by the address of Hon. P. Kenneth Peterson, Mayor of Minneapolis. In the photo the Mayor, (*center*) talks with Past President John E. Haines (*left*) and Pres. E. R. Queer (*right*)

First Session, Monday, June 23, 9:00 a.m.

Meeting in the International Room, the session was opened by Pres. E. R. Queer, University Park, Pa. After requesting J. S. Locke, general chairman of the Committee on Arrangements, to outline the program features, Mr. Locke also extended the greetings of the Minnesota Chapter.

President Queer then appointed the following 3 members to serve as the Committee on Resolutions: S. F. Gilman, Syracuse, N. Y.; E. K. Wagner, Philadelphia, Pa.; and P. E. McNall, Jr., Hopkins, Minn. He announced that the committee would report later during the meeting.

The first paper on the program entitled A Water-Cooled Luminaire in a Panel-Air System, by W. F. Spiegel (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1958, p. 139) was presented by Mr. Spiegel and was discussed by L. F. Schutrum, Cleveland, Ohio, H. E. Ziel, Detroit, Mich.,

R. W. McKinley, Pittsburgh, and E. S. Howarth, New Kensington, Pa.

The second paper on the program was presented by A. A. Putnam, Columbus, Ohio. His paper, Pulsations in Residential Gas Furnaces with Multiple-Port Burners was published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1958, p. 143.

Authors of papers for the First Session. (*Standing*) K. T. Whitby and A. A. Putnam; (*seated*) W. F. Spiegel with President Queer

Taking part in the discussion were A. A. Marks, Philadelphia, Pa., R. W. Sage, Linden, N. J., and W. B. Kirk, Cleveland, Ohio.

The third and final paper entitled Evaluation of Air Cleaners for Air Conditioning and Ventilation, Part I — Apparatus, by K. T. Whitby, A. B. Algren, R. C. Jordan and J. C. Annis (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1958, p. 171) was presented by Dr. Whitby. Those who took part in the discussion included R. D. Rivers, Louisville, Ky., R. J. Van Doornevelt, Philadelphia, Pa., and C. B. Rowe, Madison, Wis.

President Queer then announced that in accordance with the By-Law provisions, several proposed By-Law changes would be read. He called on A. V. Hutchinson, executive secretary, New York, N. Y., to present the By-Law information. Mr. Hutchinson read the proposed wording of changes to **Article IV,** *Section 6 (a);* to **Article VII,** *Section 3 (e);* to **Article VIII,** *Section 3;* and to **Article IX,** Section 1. The wording as read was that approved by the Council at its meeting on April 20, 1958. President Queer explained that it was necessary to present these proposed amendments so that they might be voted on at the next Annual Meeting of the Society. No additional amendments to the By-Laws were proposed.

President Queer also announced that a statement would be made on Wednesday morning concerning the status of the proposed merger with *ASRE*, and following this, he adjourned the session.

Second Session, Tuesday, June 24, 9:00 a.m.

First Vice Pres. A. J. Hess, Los Angeles, Calif., opened the second session in the Junior Ballroom at the Pick-Nicollet.

He introduced T. C. Min, Auburn, Ala., for the presentation of Mr. Min's paper Winter Infiltration Through Swinging-Door Entrances in Multi-Story Buildings (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1958, p. 121). Written discussions had been prepared by D. R. Bahnfleth, Urbana, Ill., H. T. Gilkey, Cleveland, Ohio, and R. A. Parsons, Lansing, Mich. Others who entered the discussion were C. M. Humphreys, Cleveland, Ohio, A. G. Wilson, Ottawa, Ont., Canada, W. R. Ratai, Milwaukee, Wis., and E. C. Miles, Pittsburgh, Pa.

The second paper was entitled Corrosion Inhibition on Tubes in Low-Pressure Steel Boilers, by W. A. Keilbaugh and F. J. Pocock (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1958, p. 129) and was presented by Mr. Keilbaugh. Among those who discussed the paper were F. N. Speller, Pittsburgh, Pa., Past Pres. L. N. Hunter, Johnstown, Pa., E. M. Mittendorff, Shipman, Va., Past Pres. John W. James, Chicago, Ill., K. T. Davis, Syracuse, N. Y., R. H. Savage, Los Angeles, Calif., and Past Pres. L. E. Seeley, Westfield, Mass.

Second Session authors. (Seated) F. J. Pocock and W. A. Keilbaugh; (standing) Necati Ozisik, L. F. Schutrum, T. C. Min

Vice President Hess then called on Necati Ozisik who presented the paper, Heat Gain Through Windows Shaded by Canvas Awnings, by Necati Ozisik and L. F. Schutrum (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1958, p. 159). Discussions of this paper were prepared by D. J. Vild, Toledo, Ohio, and W. P. Chapman, Milwaukee, Wis.

Following the presentation of the third paper, Vice President Hess adjourned the session.

Third Session, Tuesday, June 24, 9:00 a.m.

This session was called to order by Past Pres. P. B. Gordon, New York, N. Y., in the absence of 2nd Vice Pres. Walter A. Grant, Syracuse, N. Y. It was a symposium type session on the subject of Thermal Insulation, and was a joint session with *ASRE*.

Speakers and Moderator for Symposium on Thermal Insulation (Third Session). (Seated) William Turbeville, W. P. Ellis, and N. B. Hutcheon; (*standing*) C. G. Collins, Moderator M. W. Keyes, and R. B. Crepps

Mr. Gordon introduced P. N. Vinther, Dallas, Tex., symposium manager, and M. W. Keyes, Pittsburgh, Pa., moderator for the session. Five speakers had prepared papers especially for this session as follows: I — *How Research Can Improve Performance of Fibrous and Reflective Insulation* — William Turbeville, Pittsburgh, Pa.; II — *Vapor Problems in Thermal Insulation* — N. B. Hutcheon, Ottawa, Ont., Canada; III — *Block and Pipe Insulation* — R. B. Crepps, W. Lafayette, Ind.; IV — *Surfacings for Glass Fiber and Foam Thermal Insulation* — W. P. Ellis, Philadelphia, Pa.; V — *Thermal Insulation for Nuclear Systems* — C. G. Collins and G. W. Pomeroy, Cincinnati, Ohio.

The moderator, Mr. Keyes, called successively on these authors and then announced that the session was open for discussion. Among those discussing the several papers were J. T. Proctor, Dallas, Tex., John Everetts, Jr., Philadelphia, Pa., C. B. Coe, Newport News, Va., F. A. Joy, University Park, Pa., F. A. Govan, Washington, D. C., and G. D. Davis, Urbana, Ill., G. R. Munger, Toledo, Ohio, R. W. McKinley, Pittsburgh, Pa., W. A. Schworm, Ames, Iowa, F. J. Powell, Washington, D. C., J. P. Wimsatt, Chicago, Ill., and Harry Buchberg, Los Angeles, Calif.

Mr. Keyes announced that in accordance with the usual practice of the Society, the papers at this session and their discussions will not be printed in the TRANSACTIONS. Portions of them may be published in the Journal Section. Also it is expected that the several papers and the discussions may be assembled into a symposium bulletin. He stated that details concerning the availability of such a bulletin will be announced as soon as a decision is reached. He invited those present to make known their requirements concerning copies of such a proposed bulletin if issued.

At the conclusion of the discussion period and the announcements, Mr. Keyes turned the session back to Past President Gordon who thereupon adjourned it.

Fourth Session, Wednesday, June 25, 9:00 a.m.

Meeting in the International Room at the Pick-Nicollet Hotel, the session was opened by Treas. J. H. Fox, Toronto, Ont., Canada. This was a joint session with *ASRE*, was of the symposium type and on the subject of Condensing Methods.

Treasurer Fox introduced W. G. Hole, Montreal, Que., Canada, who was the symposium manager and then introduced 2nd Vice Pres. A. J. Hess who served as the moderator.

Mr. Hess announced that although the printed program showed that a series of 4 papers would be presented, it had been decided that a paper prepared by R. C. Edwards, Pompton Plains, N. J., should also be presented. Thus the series of papers was made up of the following: I — *Cooling Tower Design and Performance*

AT SPOKANE MEETING, REGION 4, CHAPTERS

Pres. E. R. Queer as he addressed the Regional Committee of Region 4 on the latest developments of the ASHAE-*ASRE Merger Plan*, with J. A. Doyle, president of Inland Empire Chapter

1st Vice Pres. A. J. Hess, luncheon speaker at Regional Committee Meeting of Region 4, discussed the *Third Year of the Society's Regional Plan*

— John Engalitcheff, Jr., Baltimore, Md.; II — *Evaporative Condensers* — D. D. Wile, Los Angeles, Calif.; III — *Air Cooled Condensers* — O. J. Nussbaum, Trenton, N. J.; IV — *Air Condensers with Gravity Flow* — R. C. Edwards; V — *Economic Evaluation of Condensing Methods* — J. L. Wolf, Philadelphia, Pa.

The moderator asked each of the 5 speakers to present his material and following this, the session was open for discussion. Among those who took part in the discussion in addition to the several authors were R. G. Werden, New York, N. Y., R. H. Savage, Los Angeles, Calif., B. C. Brown, Johnstown, Pa.

The moderator announced that it is not expected that the papers and the discussions will be printed in the TRANSACTIONS, but portions of them may appear in the JOURNAL SECTION. He announced also that it was possible that the several papers and discussions may be put together in the form of a separate bulletin. If so, details of its availability will be made known. Following this, Treasurer Fox turned the session back to President Queer.

At this time, President Queer made a statement concerning the status of the proposed merger with *ASRE*.

Statement Concerning Merger: He started by stating that before any merger could take place all members will have an opportunity to ballot on the proposal. He then reviewed the background of the proposed merger, mentioning that a suggestion for merging was made early in the 1930's. The subject arose again and while no merger took place a cooperative plan for the exchange of publications of both Societies became effective in 1941 and still continues in effect. In 1954 a Joint Committee was established to explore ways for closer cooperation.

When the ASHAE regional plan for chapter operations was put into effect, the merger proposal was entered as a chapter agenda item from Regions 6 and 7. Subsequently, the Regions Central Committee processed this item. In February 1957 the ASHAE Council passed a resolution instructing the Society representatives on the Joint Committee on Cooperation to broaden the scope of its work to (1) include a study of relevant facts relating to the respective percentage of membership which might be interested in a merger plan, and (2) to explore the possible plans for future consideration. Finally, at its January 26, 1958 meeting, the ASHAE Council voted that the ASHAE-*ASRE* Plan, dated January 26, 1958, be presented to the membership of the Society through the Chapters Regional Committee meetings held during the spring of 1958, and that the Society members on the Committee be authorized to proceed with further detailed study on the proposed merger.

To put this authorization by the Council into effect, President Queer had sent a letter outlining the proposed merger plan to all chapters and regional directors under date of February 17, 1958. In that letter he had expressed the desire of the Council that full and free discussion of the plan take place among the membership in the Chapters. The letter also outlined the procedure for doing this and at the same time outlined the tentative time schedule which appeared to be desirable and necessary in order to get prompt action on the plan and to meet JOURNAL contractural obligations.

Speakers and presiding officials at the Fourth and Fifth Sessions. (*Seated*) John H. Fox, President Queer, W. G. Hole. (*Standing*) J. L. Wolf, John Engalitcheff, Jr., Harry Buchberg, O. J. Nussbaum

As to the necessity for prompt action, President Queer pointed out that the subject has been under more or less continuous discussion since 1954 and under active discussion since January 1957. He felt, therefore, that action should be taken as promptly as possible because, as mentioned in his February 17 memorandum, many important decisions are being held in abeyance awaiting the merger action. Among these are (1) a plan to erect a new and expanded facility for Society research, (2) a new organization plan proposed by the Long-Range Planning Committee, and (3) the non-research activities of the Society had a deficit last year and are operating on deficit financing this year. Though operating surpluses remaining from earlier years are being used for the time being, certain changes in Society financing and dues will be required.

Additionally, President Queer felt that prompt action should be taken because various other decisions, besides those mentioned, are also being held in abeyance. He also felt that since it is expected that the final details of the plan will be completed shortly, the plan itself could be discussed during September, October and November in Chapter meetings and by the members at large. It is also planned to mail to each member an outline of the proposal late in August or earlier if possible. If this could be done it would permit the calling of a Special Meeting, at which

meeting the proposal can be discussed. Such a meeting could be called on or about the first of December. He noted that under the By-Laws the Council can submit the plan to the members not less than ten (10) days before the date proposed for the Special Meeting, and not more than forty (40) days. He felt that this would give each member a chance not only to vote on the question promptly, but also would permit sufficient time for adequate discussion and for any member to receive any needed information before voting. He indicated that with a two-thirds favorable vote by the members voting, either in person or by proxy, in both Societies, and approval of the New York Court, the merger could be made effective as early as the date of adjournment of the 1959 Annual Meeting. President Queer closed his statement by asking if there were any questions and indicated that the session was now open to discussion from the floor. Comments concerning the merger were made by C. D. Potter, Providence, R. I.; S. H. Nitzberg, Wood-Ridge, N. J.; B. F. McLouth, Minneapolis, Minn.; and W. A. Schworm, Ames, Ia.

In the absence of A. W. Edwards, Cincinnati, Ohio, chairman of the Nominating Committee, President Queer read the report of this committee, indicating that A. J. Hess, Los Angeles, Calif., was nominated for president; Walter A. Grant, Syracuse, N. Y., for 1st vice president; John Everetts, Jr., Philadelphia, Pa., for 2nd vice president; and J. H. Fox, Toronto, Ont., Canada, for treasurer. Nominated for members of Council were R. S. Stover, Marshalltown, Ia.; H. A. Lockhart, Morton Grove, Ill.; W. J. Collins, Jr., Oklahoma City, Okla.; and G. W. F. Myers, St. Louis.

Nominated also for the Committee on Research were R. C. Jordan, Minneapolis, Minn.; Albert Giannini, New York, N. Y.; Maurice Nelles, Chicago, Ill.; P. H. Yeomans, Philadelphia, Pa.; and H. B. Nottage, Encino, Calif.

President Queer also called for the Report of the Committee on Resolutions, and in the absence of the chairman, S. F. Gilman, Syracuse, N. Y., the report was read by P. E. McNall, Jr., Hopkins, Minn. Following the adoption of the report of the committee, President Queer adjourned the session at 12:20 p.m.

Fifth Session, Wednesday, June 25, 9:00 a.m.

Meeting in the Lakeland Room at the Pick-Nicollet Hotel, President Queer called the session to order and

Dr. R. C. Jordan presiding as Toastmaster at the Joint Dinner of the two Societies

introduced H. L. Barnebey, Columbus, Ohio, who presented his paper, Activated Charcoal for Air Purification (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1958, p. 153). The paper was discussed by Warren Viessman, Baltimore, Md., S. F. Duncan, Los Angeles, Calif., S. B. Smith, Pittsburgh, Pa., and Harry Buchberg, Los Angeles, Calif.

The next paper was presented by its author Professor Buchberg and was entitled Cooling Load from Pretabulated Impedances, by Harry Buchberg (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1958, p. 115). The paper was discussed at some length by G. V. Parmelee, Dhahran, Saudi Arabia.

The third paper on the program was entitled Solar Energy Utilization for Heating, Cooling, Distillation and Drying (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1958, p. 147). This paper was a technical contribution made by the members of the Technical Advisory Committee on Solar Energy Utilization and was presented by the chairman, R. C. Jordan, Minneapolis, Minn. Discussions were received from C. P. Davis, Jr., Manhattan, Kans., and R. W. Sage, Linden, N. J.

At this time, President Queer announced that the closing items on the program would be taken up in the fourth session in the International Room and suggested that all present should attend that session. He then adjourned the fifth session at 11:30.

Joint Sessions with *ASRE*

Included on the program of the *ASRE* were 2 joint conferences. One of these was held at 2:30 p.m., Tuesday afternoon at the Hotel Leamington under the chairmanship of W. L. McGrath, Syracuse, N. Y. The conference was devoted to the subject of *Heat Operated Refrigeration and Air Conditioning*. There were 4 speakers. The first of these was G. B. Priester, Baltimore, Md., whose subject was *The Future of Gas for Air Conditioning;* the second speaker was R. B. Smith, New York, N. Y., with the subject of *New Developments in Gas-Fired Air Conditioners for Residences;* J. F. Moore, Dallas, Tex., had as his subject *Absorption Refrigeration for Large Air Conditioning Installations;* the fourth subject was *Steam Driven Turbine Refrigeration for Air Conditioning*, and was by B. A. Dmitrieff, New York, N. Y.

The second conference, which was devoted to *Education for Careers in Refrigeration and Air Conditioning*, was held at the Leamington Hotel on Wednesday afternoon with H. M. Hendrickson, Seattle, Wash., as chairman and Past Pres. John W. James, Chicago, Ill., as co-chairman.

The subject of *The Role and Responsibility of the Educator* was covered by J. B. Chaddock, Troy, N. Y., and W. F. Stoecker, Urbana, Ill.; C. M. Ashley, Syracuse, N. Y., had the topic *What Industry Expects of the Engineering Graduate;* B. H. Jennings, Cleveland, Ohio, had been assigned the subject of *How Can We Interest High School and Junior College Students in our Industry?;* Past Pres. P. B. Gordon, New York, N. Y., spoke on *The Role and Responsibilities of Trade Associations and Technical Societies.*

These conferences on the *ASRE* program proved to be attractive features to many of the ASHAE group who were in attendance.

Special Events

One of the most appreciated features of the meeting was the Hospitality Room, available through the courtesy of the Minnesota Chapter throughout the meeting. Here, coffee was served continuously and there were comfortable arrangements for relaxing and for conversation.

A Reception was arranged by the Committee for Sunday afternoon, June 22, and it attracted a large crowd, being open to both Society members and members of *ASRE.*

That same evening, the *ASRE* had arranged for a Reception at the Leamington Hotel with refreshments and with the Aquatennial Preview as entertainment. At this reception, ASHAE members and their guests were invited.

At the Welcome Luncheon on Monday noon which drew a capacity attendance, Past Pres. John E. Haines, Minneapolis, Minn., served as toastmaster.

Inspection trips for men were arranged for both Monday and Tuesday afternoons, with the one on Monday touring the Minneapolis-Honeywell Plants. The Tuesday afternoon trip featured the Southdale Shopping Center where the reverse-cycle mechanical plant was open for inspection.

The County Fair held on Monday evening brought out an attendance of nearly 600 with the usual County Fair attractions outdoors at the Lafayette Club, Lake Minnetonka, and with dinner and dancing inside the clubhouse.

On Tuesday evening, the members of both societies were guests at a Cocktail Party given by *ARI* at the Leamington Hotel.

At the joint dinner also held on Tuesday evening, Dr. R. C. Jordan, Minneapolis, Minn., was toastmaster. Officers of both societies were presented. So also were Mr. and Mrs. F. B. Rowley, and attention was called to the point that the day represented their 50th Wedding Anniversary. At the dinner also, President Queer presented the President's Memory Book to Past President Gordon. Results of the Golf Tournament were announced and the trophies were given out. A group of German engineers present by invitation of the Society was also introduced by the toastmaster. Entertainment and dancing followed.

Past Pres. and Mrs. P. B. Gordon enjoy the dinner served during the County Fair party

There were three events on the program for children including a trip to the zoo, a swimming party and a theatre party.

Arrangements had also been made on the program to entertain the ladies with a get-together brunch on Monday and a trip to the Southdale shopping center on Monday afternoon. On Tuesday there was a joint trip with the *ASRE* ladies to the Betty Crocker Kitchens with lunch at Wayzata Country Club. On Wednesday afternoon there was a card party for the ladies at the hotel.

Golf

With both societies meeting concurrently, each held its own golf tournament. The *ASRE* Tournament took place at Edina Country Club on Tuesday, 12:00 noon. The annual ASHAE Tournament was held at Golden Valley Country Club on Monday, 12:00 noon. Chairman for the occasion was C. T. Hastings, Minneapolis, Minn.

The Eichberg Memorial Cup went to the Minnesota Chapter (E. J. O'Donnell, E. R. Huckins, S. L. Furber) with a net score of 227. The Past Presidents Research Bowl was awarded to E. J. O'Donnell, Minneapolis, Minn., for low net score, while the Paul Bunyan Cup was won by J. E. Murray, San Francisco, Calif. A windbreaker as the blind bogie prize was awarded to D. A. MacWatt, New York, N. Y., E. R. Huckins, Minneapolis, Minn., won a golf shirt for being closest to the pin on No. 17 hole. A small golf trophy was the prize going to C. R. Egan, Minneapolis, Minn., for low gross. Golf balls were awarded for those having the most 3's, most 4's, most 5's, most 6's and most 7's, and went to W. C. Isaac, Montreal, Que., Canada; E. P. Danielson, Los Angeles, Calif.; Albert West, San Francisco, Calif.; L. T. Bennett, Minneapolis, Minn.; and W. C. Kruse, Jr., Newark, N. J.

President Queer presenting the Memory Book to Past President Gordon

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JOINT STATEMENT ON PROPOSED MERGER

Following is the full text of a joint statement of the Councils of ASHAE *and of ASRE issued under date of July* 1, 1958.

NEW YORK, NEW YORK — In a joint statement issued by the Councils of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS and The American Society of Refrigerating Engineers it was announced they have approved in principle a method of merging the two Societies. The *ASRE* members in attendance at their 54th Annual Meeting authorized submission of this proposal for balloting by the *ASRE* membership.

E. R. Queer, ASHAE President, and Cecil Boling, *ASRE* President, further announced that present plans contemplate that the proposal for a merger and proxy ballots will be officially mailed to the members of both Societies in late October.

Full particulars of the merger plan will be mailed to the members of both ASHAE and *ASRE* by September. Ballots will be taken in person or by proxy at the 45th Semi-Annual Meeting of *ASRE* in New Orleans, La., on December 1, 1958 and at Special Meeting of the ASHAE membership on December 1, 1958.

Seated (center): **G. W. Labohm, *chairman.* Heating and Ventilating Section, *German Engineers Society (Verein Deutscher Ingenieure)* with members of the ASHAE International Affairs Committee. To Mr. Labohm's right, Past Pres. L. N. Hunter; to his left, Past Pres. John W. James. *Standing:* Committee members John Grossinger, G. B. Baan, G. H. Schoenbaum**

GERMAN ENGINEERS VISIT SOCIETY

To study U. S. methods their itinerary included New York, Chicago, Milwaukee, Minneapolis, Johnstown, Pa.

A group of 12 German engineers visited the United States during June at the invitation of the Society. An important object of their visit was to study American methods of installation of residential oil heating and to become familiar with the codes and standards governing such installations as made in the United States. All are officials of the West German Government.

Arrangements were made for them to meet with officials of the Fire Department, the Department of Buildings, and other officials in New York, Chicago, Milwaukee, Minneapolis, and Johnstown, Pa. Their itinerary also included inspection trips to typical residential developments in course of construction in Long Island, Levittown, Pa., and suburbs of Chicago. The group also attended some sessions of the Semi-Annual Meeting of the Society in Minneapolis.

Present to welcome the group on behalf of the Society at the Hotel Biltmore in New York on June 12 were, President Queer, Past Presidents, P. B. Gordon and L. N. Hunter, Carl F. Kayan, Columbia University, and W. J. Olvany, president of the New York Chapter. President Queer made the welcoming remarks at the meeting.

When the group completed their visit, a bon voyage was held on June 30th in New York and present on this occasion were, President Queer, Past Presidents, P. B. Gordon and L. N. Hunter, Professor Kayan, G. B. Baan and G. H. Schoenbaum of New York, and J. S. Grossinger, Johnstown, Pa. President Queer expressed the pleasure of the Society at having the group as visitors, while Professor Kayan spoke to the group in German.

Arrangements for the visit and its accompanying opportunity to exchange technical information were made as an activity of the Society's newly appointed International Affairs Committee. The members of this committee are: Past Pres. L. N. Hunter, Johnstown, Pa.; G. B. Baan, New York, N. Y.; Past Pres. P. B. Gordon, New York, N. Y.; J. S. Grossinger, Johnstown, Pa.; Past Pres. John E. Haines, Minneapolis, Minn.; Past Pres. John W. James, Chicago, Ill.; Carl F. Kayan, New York, N. Y.; and G. H. Schoenbaum, New York, N. Y.

Standing: **W. K. F. Spillhagen, Official of the Highest Building Authority, Munich, Germany; G. B. Baan and J. S. Grossinger, members, ASHAE International Affairs Committee. *Seated:* Past Pres. P. B. Gordon; H. A. A. Koch, official, Bavarian Ministry of the Interior, Munich, Germany**

Standing: **P. F. Thees, *Central Association of the Chimney Sweeper Trade,* Dusseldorf; C. D. Beenken, Technical Property Insurance Underwriters Committee, Kiel, Germany; C. F. Krienke, Hamburg, Germany; R. Merlander, secretary, Flammable Liquids Committee, Hannover, Germany. *Seated:* H. H. Gerhardt, Building Police Official, Berlin, Germany; Past Pres. L. N. Hunter**

President Queer *(center)* with German engineers: A. W. Hans, Municipal Fire Fighting Department, Cologne, Germany; A. Vitt, Official in Charge of Building and Construction Supervision Reconstruction Ministry, Dusseldorf, Germany; E. Jacobi, staff official, Reconstruction Ministry, Dusseldorf, Germany; G. W. Labohm; H. O. D. Reinders, secretary, Heating and Ventilating Section, *German Engineers Society*; G. Schiemann, Boiler and Pressure Vessel and Inspection Board, Dusseldorf

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CANDIDATES FOR MEMBERSHIP

Listed here are the names of 21 men who are the candidates for membership or advancement in membership grade. Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before August 31, 1958 of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: ******Advancement* **†***Reinstatement*

California (*Region* 4)

ANDERSON, W. R., Dvlpt. Engr., Robertshaw-Fulton Controls Co., Anaheim.

POLLOCK, L. S., Sales Engr., Carrier Corporation, San Francisco.

Georgia (*Region* 3)

KNAGGS, H. J., Capt., Planning & Programming Officer, 804th Installation Sq., Hunter Air Force Base.

MCCREERY, M. B., Engr., U. S. Corps of Engineers, Savannah.

Illinois (*Region* 2)

DEBES, C. N.†, Owner, Charles N. Debes & Assocs., Rockford.

MEEG, A. B., Sales Mgr., Bell & Gossett Co., Morton Grove.

SCHMIDT, R. D., Sales Engr., Barber-Colman Co., Uni-Flo Div., Rockford.

Iowa (*Region* 3)

CAMPBELL, C. B.*, Secy., Campbell Heating Co., Des Moines.

HOWARD, R. T., JR.*, Chief Engr., Wm. E. Nanes, Cons. Engr., Des Moines.

Louisiana (*Region* 5)

KOZAKIS, ACHILLES, Assoc. & Dist. Mgr., James H. Howard & Assocs., Inc., Lake Charles.

Michigan (*Region* 2)

MEDEN, F. E., Sr. Design Engr., Chevrolet Engineering Center-Plant, Engineering Dept., Detroit.

PETRIK, J. J., Head, Dept. of Mechanical Engineering, Detroit Institute of Technology, Detroit.

Minnesota (*Region* 3)

ASHENFELTER, C. B.*, Sales Engr., Johnson Service Co., Minneapolis.

New York (*Region* 1)

CHAIT, G. L., Asst. Office Mgr., John J. Nevbitt, New York.

VISCO, A. R., Partner, Visco, Franzblau, Associates, Cons. Engrs., New York.

WALTERS, J. H., Repr., Clarage Fan Co., New York.

North Carolina (*Region* 5)

CONRAD, H. G., Mech. Draftsman, Mechanical Engineers, Inc., Charlotte.

ROTH, A. W., Assoc. in charge of Mechanical Engineering, J. N. Pease & Co., Charlotte.

SCOTT, B. W. JR., Sales Engr., Buensod-Stacey, Inc., Charlotte.

Pennsylvania (*Region* 1)

HEIL, S. D., Sales Engr., F. W. Schimmel, Harrisburg.

Rhode Island (*Region* 1)

MACLELLAN, D. H., Chief Engr., E. M. Mauro Co., Providence.

Tennessee (*Region* 5)

HALL, J. P., Engr., Thorpe Engineering Co., Memphis.

Texas (*Region* 6)

MCCALLY, J. R., Field Supt., C. Wallace Plumbing Co., Inc., Dallas.

Washington (*Region* 4)

BROOMELL, H. B., Chief, Design Branch, Public Buildings Service, Gen'l Serv. Adm., Seattle.

Wisconsin (*Region* 2)

ARNTZEN, E. G., Student Sales Engr., The Trane Co., La Crosse.

Australia

FORD, R. J., Director, Ford & Swinton, Victoria.

Canada (*Region* 7)

BESSNER, L. M., Vice Pres., Singer Plumbing & Heating Co., Montreal, Que.

CARRUTHERS, G. R., Sales Specialist, Canadian General Electric Co., Ltd., Quebec, Que.

CONN, L. G., Design Draftsman, Field Supvsr., Angus, Butler & Assocs., Calgary, Alta.

JOURNAL SECTION

AWARD TO HEILMAN

One of 12 engineers selected to receive the Award of Merit from American Society for Testing Materials is R. H. Heilman, Pittsburgh, Penn. Mr. Heilman is a long-time member of the ASHAE and has been active for many years on committees as well as having contributed papers to Society meeting programs.

HOLMES OPENS CONSULTING OFFICE

Donald P. Holmes, mechanical engineer and member of the Society, has opened an office as a consulting engineer at 3131 Withers Avenue, Lafayette, California. He was formerly a lecturer in Heating and Air Conditioning at the University of California in Berkeley, and has been associated with engineering firms in the Bay area since 1946. Mr. Holmes is a member of the Golden Gate Chapter.

OBITUARIES

JAMES V. BAMFORD
Los Angeles, Calif.

James V. Bamford, 49, died this spring. He was a partner in the firm of Stockley & Bamford, Consulting Engineers, and had been very active in designing mechanical installations.

Mr. Bamford is survived by his wife, daughter, mother and brother. He will be missed by his many friends in the Southern California area.

FRANK X. MORGAN
Philadelphia, Pa.

Frank X. Morgan, a member of the Society since 1947, died June 8 at Passaic (N.J.) General Hospital after an illness of two months.

A native of Philadelphia, he was chief mechanical engineer with Mahoney and Troast, Passaic, N.J., for fourteen years. Mr. Morgan was also a member of the Vermont Society of Engineers and the Engineers Club of Philadelphia.

Surviving are his widow of 2424 78th Ave., Philadelphia, and three married daughters.

Attention!!
Members of ASHAE
Moved or Moving?

Please advise us at once of any change in your business or home address, indicating which is for mail.

ASHAE Headquarters
62 Worth St.
New York 13, N. Y.

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Headquarters Office
62 Worth St., New York 13, N. Y.
Tel: BArclay 7-6262

(For names of Society Officers see p. 128)

Research Laboratory
7218 Euclid Ave., Cleveland 3, Ohio
Tel: UTah 1-6161

The Standards Committee, Its Subcommittees and Representatives

The Standards Committee considers all scientific matters pertaining to codes and standards, and operates under the direction of the Council. It appoints standards subcommittees as necessary, and society standards representatives on joint committees and on committees formed by other organizations.

ASHAE Standards Committee

P. N. Vinther, *Chairman;*
A. B. Algren, K. T. Davis, Albert Giannini,
Fred Janssen G. B. Priester.

Standards Subcommittees

ASHAE Committee on Minimum Outdoor Air Requirements for Air Conditioned Spaces: Albert Giannini, *Chairman*, C. B. Gamble, R. A. Gonzalez, W. J. McConnell, R. J. Salinger, H. G. Strong.

ASHAE Committee on Revision of Standard for Testing and Rating Return Line Low Vacuum Heating Pumps: W. M. Wallace II, *Chairman*, H. E. Adams, H. S. Bean, A. H. Church, L. M. Nechine, E. G. Keller, A. O. Roche, Jr., D. H. Whittington.

ASHAE Committee for Review of Standard Test Code for Air Moving Devices: S. Konzo, *Chairman*, L. G. Seigel, G. L. Tuve, D. D. Wile.

ASHAE Committee on Revision of Code for Testing and Rating Unit Ventilators: J. W. McElgin, *Chairman*, L. A. Chetty, A. F. Hubbard, D. H. Kranz, L. G. Miller.

ASHAE Committee on Guidance for Members in Preparation of Local Codes: H. G. Strong, *Chairman*, J. R. Chamberlain, K. T. Davis, C. L. Grandstaff, W. G. Martin, Jr., H. B. Nottage, C. H. Randolph, A. L. Wales.

ASHAE Committee on Test Standard for Testing and Rating Gravity Type Roof Ventilators: Linn Helander, *Chairman*, G. C. Breidert, F. N. Calhoon, R. B. Engdahl, W. V. Hukill, J. P. Johnson, K. E. Robinson, F. B. Rowley, L. J. Shumaker.

ASHAE Committee on Test Standard for Evaluating Air Cleaning Devices for General Ventilation: P. R. Achenbach, *Chairman*, W. C. L. Hemeon, R. F. Logsdon, P. E. McNall, R. J. Salinger.

ASHAE Committee on Test Standard for Sorbent Type Dehumidifiers: G. C. F. Asker, *Chairman*, E. S. Howarth, H. L. Barnebey, W. P. Cummings, W. E. Emley, Jr., R. J. Getty, R. R. Goll, T. E. Gravenstreter, Anthony Hass, G. A. Kelley, E. R. McLaughlin, R. M. Milton, H. E. Parker, W. L. Ross, G. L. Simpson.

ASHAE Committee on Code for Testing Heavy Duty Furnaces and Direct-Fired Unit Heaters: E. K. Campbell, *Chairman*, Bowen Campbell, A. P. Loeb, C. J. Low, W. J. McGirl, B. F. McLouth, F. L. Meyer, L. G. Miller, A. A. Olson, H. A. Pietsch, O. J. Ress, H. A. Soper.

ASHAE Committee on Code for Testing and Rating Evaporative Coolers: R. S. Ash, *Chairman*, S. F. Duncan, H. S. Dutcher, E. F. Gritton, Leo Hungerford, C. B. Rowe, W. T. Smith, J. R. Watt.

Society Standards Representatives

On Joint Committees with Other Organizations

Committee on Standard for Comfort Air-Conditioning (ASHAE, *ASRE, USPHS, ARI*): W. L. Fleisher, *Chairman*, and O. W. Armspach. Also *members-at-large* M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton.

ASRE-ASHAE Joint Standard on Rating and Testing Air Conditioning Equipment with Respect to Sound: C. M. Ashley, R. D. Madison, A. F. Hubbard.

ASRE Task Committee for Revision of Methods of Rating and Testing Air Conditioners: H. T. Gilkey, L. G. Miller, *alternate*.

On *ASA* Sectional Committees

A-13 — Scheme for Identification of Piping Systems: Harry H. Bond.

A-53 — Building Code Requirements for Light and Ventilation: John G. Eadie, Myron C. Beman, *alternate*.

A-62 — Coordination of Dimensions of Building Materials and Equipment: A. W. Knecht.

A-114 — Application Standards for Thermal Insulating Materials: M. W. Keyes, *Chairman*.

B-211 — American Standard for Pipe Threads: L. L. Munier.

B-9 — Safety Code for Mechanical Refrigeration: Lee Nusbaum, W. W. Grear, *alternate*.

B-16 — Standardization of Pipe Flanges and Fittings: L. L. Munier. Subcommittee No 9 on Solder-Joint Fittings: L. J. LaTart.

B-31.1 — Code for Pressure Piping-Subcommittee for Revision of Section 5 Refrigerant-Piping: S. I. Rottmayer.

B-53 — Standard Refrigeration Nomenclature: H. J. Ryan.

B-76 — Industrial Cooling Towers: Paul A. Bourquin.

S-1 — Acoustics: R. D. Madison, Paul D. Close, *alternate*.

Y-1 — Abbreviations; Y-10 — Letter Symbols: R. W. Roose, Carl H. Flink, *alternate*.

Y-14 — Drawings and Drafting Room Practice: F. Honerkamp.

Y-32 — Graphical Symbols and Designations: E. H. Munier, Carl H. Flink, *alternate*.

Z-9 — Safety Code for Exhaust Systems: W. M. Wallace II, W. S. Bondy, *alternate*.

Z-11 — Petroleum Products and Lubricants: Bruce L. Evans.

Z-62 — Uniform Industrial Hygiene Standards: Allen D. Brandt.

Z-74 — Fundamentals of Performance of Effluent Air and Gas Cleaning Equipment: K. E. Robinson.

On *ASTM* Committees

Thermal Insulating Materials: F. B. Rowley, E. R. Queer, *alternate*. Thermal Insulating Materials Planning Committee: E. R. Queer.

Acoustical Materials: A. W. Knecht.

Gaseous Fuels: E. A. Norman, Jr.

Atmospheric Sampling and Analysis: M. G. Kershaw.

On *NFPA* Committees

Hospital Operating Rooms: R. P. Gaulin, N. Glickman, *alternate*.

On *American Concrete Institute* Committees

No. 332 — Recommended Practice for Residential Concrete Work: W. P. Chapman, R. L. Maher, *alternate*.

Society Organization Personnel

General Committees: The By-Laws provide for 9 such committees. The latest list appears in the July, 1958 issue on page 148

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints its Technical Advisory Committees as needed. The 1958 personnel appears in the June 1958 JOURNAL SECTION on page 174

Standards Committee: The 1958 personnel appear above.

Special Committees: At present there are 9 of these committees. The latest listing appears in the July, 1958 issue on page 148

Nominating Committee: The committee's membership is fixed by the By-Laws. The latest listing appears in the July 1958 issue on page 148

Society Regional Organization: The 1958 listing of the names of the Regional Directors and of the members of the Chapters Regional Committees was published in the May 1958 issue on page 194

Society Chapters and Branches: The Society has chartered 72 Chapters, 1 Overseas Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries was published in the May 1958 issue on pages 195-196

28 year old installation of POWERS No. 11 Self-Operating TEMPERATURE REGULATORS

Each of the four 6" POWERS No. 11 Regulators shown above controls steam supply to a 10,000 gal. water heater. The 4 water heaters provide 140°F. water for use throughout the building.

"all are still giving good control"

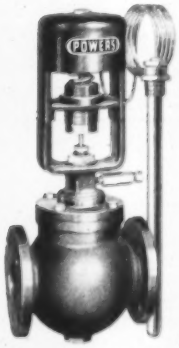
. . . states Mr. George Volkart, Chief Engineer of Pittsburgh's well known Hotel Wm. Penn. All four of the Powers regulators were installed in 1930. Operating top for one regulator was replaced in 1954. Now (April, 1958) they are still giving the same good control we have had for over a quarter of a century."

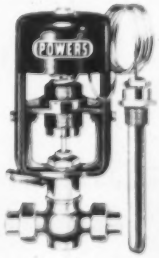
Will the temperature regulators you specify give performance records like those above? With today's high cost of maintenance, Powers time-proven QUALITY controls are a more profitable investment than ever before.

Right type of Regulator and proper size valve is important for good control. Make sure, call Powers nearest office for help with your problems of temperature control.

Often pay back their cost 3 to 6 times a year. By preventing fuel losses caused by OVER-heated water and lasting many years, Powers No. 11 Regulators are a highly profitable investment.

Better temperature control results from their powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.





(c69a)

POWERS No. 11 Self-Operating TEMPERATURE REGULATORS
Are fully described in Bulletin 329. Write for a copy.

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

65 years of Automatic Temperature and Humidity Control

HEV-E-OIL burners
HEV-E-DUTY gas burners

preferred throughout the world

In new installations and replacements, users of Hev-E-Oil and Hev-E-Duty Gas Burners the world over report significant reduction in costs plus better performance.

Boiler room of Berlin "Life" has three Hev-E-Oil Burners.

Complete line of burners is built in 8 sizes . . . 5 to 150 gph capacities . . . for boilers up to 500 hp.

Hev-E-Oil economy picked over 16 other burners for new Berlin Life Insurance Building

When Berlin Life Insurance installed Hev-E-Oil Burners in their new Wiesbaden office, it was another decision for economy and efficiency . . . more proof of the growing preference everywhere for Hev-E-Oil and Hev-E-Duty Gas Burners. Growing because they do offer the most practical approach to lowering heating costs. And because Industrial Combustion Burner design and dependability stand out in any comparison of heating systems. To find out how you can profit from this high heating efficiency, write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wisconsin, Dept. HPA-8.

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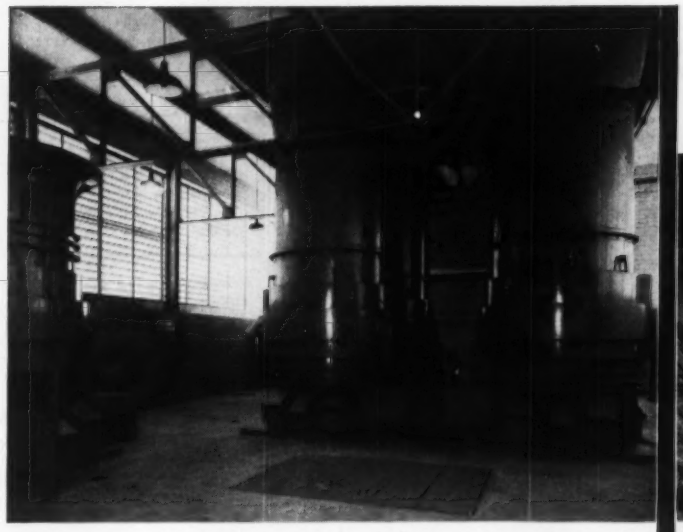
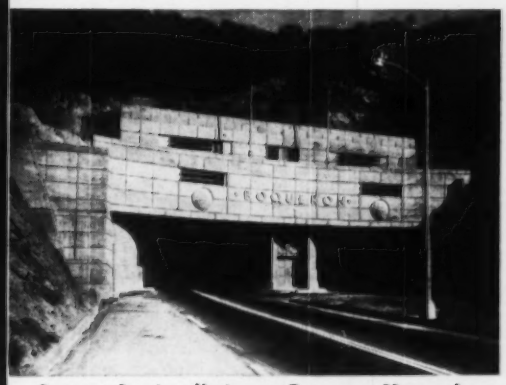


The new Hampton Roads Tunnel uses 16 Joy Axivane Fans to move 3,406,000 cfm of both fresh and exhaust air.



Compact Joy installation at Boqueron, Venezuela, moves 3,952,000 cfm of air through a 1 mile tunnel.

Ventilation Problems:

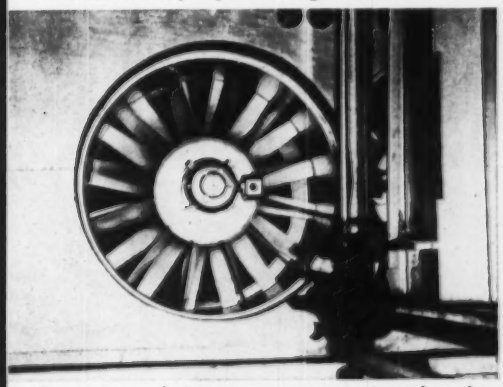
JOY AXIVANE Handles the Hard Jobs

If you have a really tough ventilating job coming up . . . moving large volumes of air . . . variable pressures and volumes . . . unpredictable resistance . . . cramped space allotment . . . better take a look at the Joy Axivane Fans.

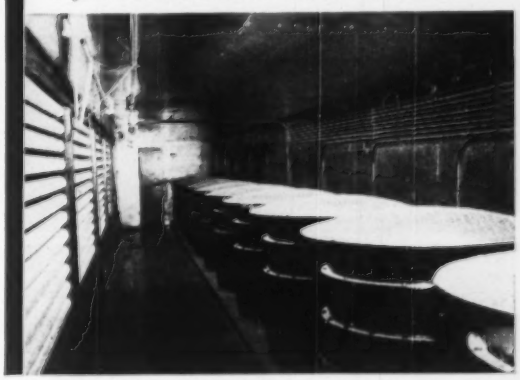
Compact design, with the motor *inside* the fan gives you more air per pound of fan and motor . . . more air per cubic foot of fan. The straight-thru design allows in-duct installation; becomes a *part* of the duct; eliminates offsets, elbows, drives and guards.

Pre-lubricated, double-shielded ball bearings permit the fan to be installed in *any* position. Adjustable blades allow for unpredictable resistance . . . permit changes in volume or pressure, *after* the fan is installed.

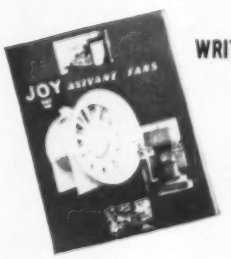
You choose from a standard line of over 136 models . . . and still have the advantage of Joy's custom engineering service. Joy Axivane Fans can make your next ventilating job a lot easier . . . one reason why Joy gets the tough assignments.



Joy Axivane design means power savings through adjust-in-motion blades at Alcoa's Texas Plant.



Dependable Joy installation circulates freezing air in California Cold Storage Plant.



WRITE FOR FREE BULLETIN 244-41

Get complete information about Joy Axivane Fans from **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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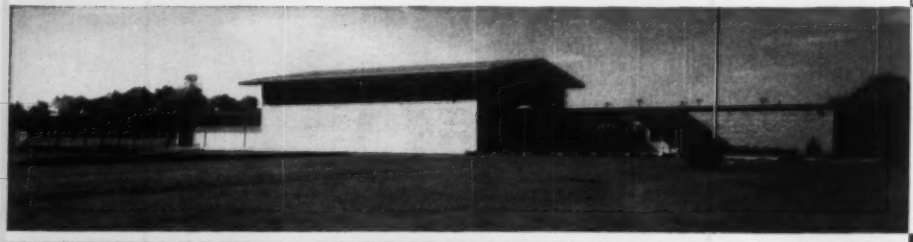
because taxpayers "specified" low maintenance costs

for these new schools in the greater Detroit area . . .

Jenkins Valves were selected for long-range economy

Architects for all five school buildings:
O'Dell, Hewlett & Luckenbach Associates-Architects
Chief Mechanical Engineer:
Donald J. Sachs, P.E.

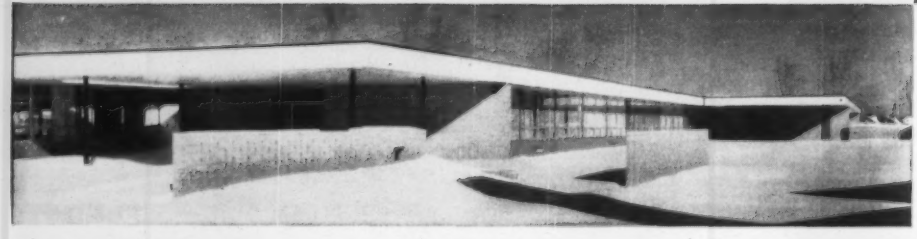


Midvale Elementary School
Birmingham, Mich.
General Contractor:
Freeman Darling Company
Mechanical Contractor:
Great Lakes Power Piping

Lederle Junior High School
Southfield, Mich.
General Contractor:
Alfred A. Smith
Mechanical Contractor:
J. P. Davis Co.

Eleanor Roosevelt Elementary School
Oak Park, Mich.
General Contractor:
Darin & Armstrong
Mechanical Contractor:
J. P. Davis Co.

John Dewey Elementary School (two units)
Oak Park, Mich.
Unit 1. General Contractor:
Darin & Armstrong
Mechanical Contractor:
Major Plumbing, Heating Co.
Unit 2. General Contractor:
Atkin-Fordon Co.
Mechanical Contractor.
E. E. Lynch Co.



Waldo E. Lessenger School
Oak Park, Mich.
General Contractor:
Atkin-Fordon Co.
Mechanical Contractor:
E. E. Lynch Co.

Second only to the need for five new schools in the greater Detroit area was the importance—as in *any* community today—of saving taxpayers' dollars. Jenkins Valves in school buildings not only have added a *fourth* R—Reliability . . . their economy of maintenance and long operating life help taxpayers save money.

Confidence in the extra measure of efficiency built into Jenkins Valves is shared by leading architects, engineers, and contractors in every field of construction. Yet these valves *cost no more*. Jenkins Bros., 100 Park Avenue, New York 17.

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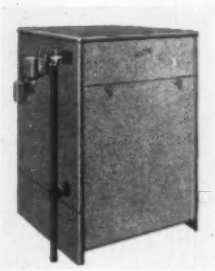
VALVES

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

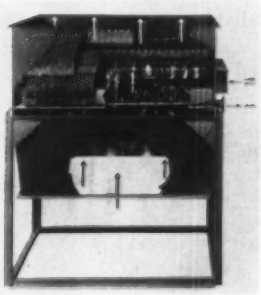
For reviews of Recent Trade Literature see Page 216



Gas Boiler . . .

. . .in new series designed for apartment houses, commercial installations —*Burnham Corp., Dept. HPAC, Main St., Irvington, N. Y.*

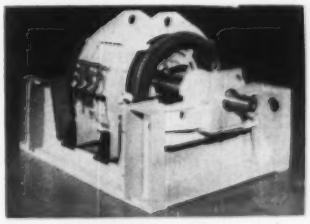
"No. 70 Holiday" produced in eight sizes. Capacities range 600 to 2700 sq ft EDR for water; 325 to 1580 sq ft EDR for steam. Built-in tankless water heaters which produce 5 to 15 gpm available for water and steam models. Unit has vertical flue travel, in which heated gases pass over special heat absorbing surfaces studded with heat-absorbent pins; flueways accessible without disturbing piping or draft hood.



Mist Collector . . .

. . .designed especially to eliminate acid or alkali mist generated in plating, other industrial processes— *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

"Type M Cycoil" operates on counterflow air cleaning principle, using water rather than oil as collecting medium. May be operated as exhaust or blowthrough cleaner with contaminated air or exhaust gas flowing upward through perforated plate into eliminator section. Eliminator section consists of fluid bed, polyethylene pad into which water is introduced counterflow to air. Moving air causes liquid level to be established in media, provides flooded contact surfaces for effective scrubbing. Available in designs of 2 and 4 in. pressure loss and in seven sizes with capacities 1200 to 24,500 cfm.



Large A-C Motors . . .

. . .with enclosure bolted to base of motor, making wound stator fully accessible—*Westinghouse Electric Corp., Dept. HPAC, Pittsburgh.*

Company's squirrel-cage, wound rotor, synchronous motors from 250 to 7000 hp (depending on speed) for horizontal utility and industrial drive applications redesigned to use six basic enclosures, 30 frame sizes. Stator not limited by surrounding enclosure; proper air gap in winding operation obtained by adjustment.

Fan-Coil Air Conditioners . .

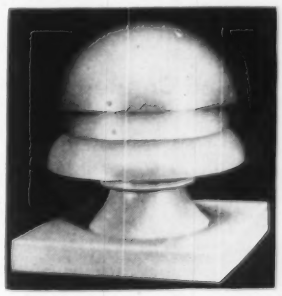
. . .designed to eliminate need for ductwork in year 'round commercial installations—*York Corp., Dept. HPAC, Roosevelt Ave., York, Pa.*

Floor, wall, ceiling units available in 200, 300, 450, 600 cfm models. Units may be connected to central chilled water cooling and hot water heating systems. Temperature control through three speed fan switch and choice of manual, automatic self-contained or pneumatic water controls. Outside air louvers available for ventilation with all floor models. Water supply, return, drain lines are only piping required for new air conditioners.

Boiler-Burner . . .

. . .designed for easy installation— *Spencer Heater, Lycoming Div., Avco Mfg. Corp., Dept. HPAC, 652 Oliver St., Williamsport, Pa.*

Units "CP-220" through "CP-500" of company's "C" series equipped with oil burners with burner mounted electronic safety controls and ignition to prevent "hard starts" which occasionally result in large inputs of light oil. Procedure gives smooth, quiet start with full capacity operation in 15 to 20 sec. Unit supplied with precast 4 in. refractory base that includes pressure relief doors as part of base assembly. Boiler tubes cleaned through front flue door. "C" series includes capacities 312,000 to 1,200,000 Btu per hr for steam, and 351,000 to 1,350,000 Btu per hr for water.



Power Roof Exhauster . . .

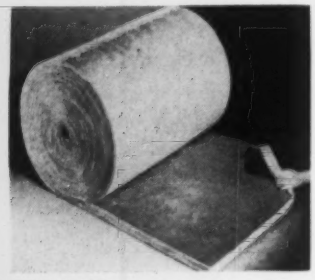
. . .molded in reinforced glass fiber —*Gallaher Co., Dept. HPAC, 1108 Dodge St., Omaha.*

"Super Air-Vans" constructed of

EQUIPMENT DEVELOPMENTS

Continued

sound absorbing, dampening glass fiber with strength equal to steel, according to manufacturer. Glass fiber unaffected by corrosive action of salt spray, also resistant to common acids, gases, greases, moisture laden air. Incorporates scroll design intended to give efficiency to 4 in. water gage. Motor is out of airstream, protected by air seal-off. Units are weatherproof, shipped assembled; internal weatherproof conduit included. Capacities range 100 to 11,000 cfm.



Duct Liner . . .

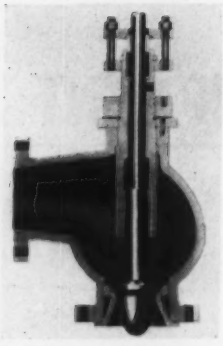
. . . of lightweight glass fiber construction developed for insulating, sound absorbing in air conditioning, heating ducts—*Ehret Magnesia Mfg. Co., Dept. HPAC, Valley Forge, Pa.*

"Therma-K" duct liner designed for applications where temperatures range subzero to 350 F. Liner offers low air resistance, making it applicable for carrying air at high velocities. Has low thermal loss (0.25 Btu per sq ft per hr) at 100 F mean, is lightweight (densities 0.5 to 2 lb per cu ft). Available in 100, 50 ft long rolls, in widths 36, 48 in. thicknesses ½, 1 in.

Air Cooled Condensers . . .

. . . of self-contained, remote types for ceiling or wall suspension—*Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

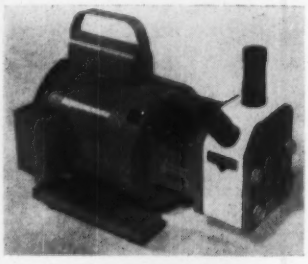
"ACC Series-2000" air cooled condensers in sizes 10, 15, 20, 25 tons are belt driven. Units of 3, 5, 7 tons are direct driven. Said to operate on "draw-thru" principle for uniform use of coil, easy cleaning operation of finned surfaces.



High Pressure Valves . . .

. . . in sizes 1 to 14 in., with pressure ratings to 2500 psi lb.—*Conoflow Corp., Dept. HPAC, 2100 Arch St., Philadelphia 3.*

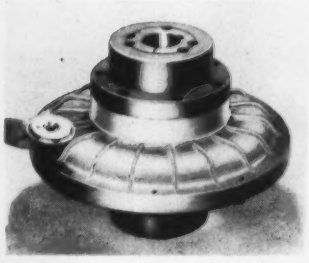
"S Valve" is series of single-seated, angle-design valves incorporating following features: oversized stem and stem guide; venturi seat ring and parabolic plug for tight shutoff. Sizes 1 through 4 in. have ASA ratings to 2500 psi; sizes 6, 8 in. to 1500 psi; 10, 12, 14 in. to 300 psi. In smaller sizes, valves equipped with pneumatically positioned power actuator which provides sensitive valve throttling in response to standard 3-15 psi instrument signals. In larger sizes with high power requirements, valves supplied with pneumatic actuator capable of handling valve stem loads to 60,000 psi.



Plastic Sealless Pumps . . .

. . . in three new models—*Vanton Pump & Equipment Corp., Dept. HPAC, 201 Sweetland Ave., Hillside, N.J.*

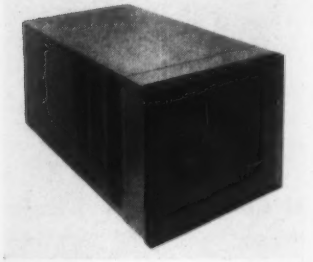
All units self-priming, feature construction without stuffing boxes, shaft seals and with no metal contact with pumped liquid. Materials are of interchangeable component construction. "Model CC" is pump close-coupled to ¼ hp a-c 60 cycle 115/230 volt single phase, totally enclosed, compact capacitor start motor. Intended for use with extremely corrosive fluids, abrasive slurries, viscous materials. "Model FM" is face mounted pump designed to operate with equipment that already includes power take-off. "Model PM" is pedestal mounted self-contained pump assembly furnished for direct connection to motor device. Pump housings, liners for all three models offered in variety of synthetic materials. Capacities 1/3 to 10 gpm available.



Flexible Couplings . . .

. . . in four new sizes—*Dodge Mfg. Corp., Dept. HPAC, 500 S. Union St., Mishawaka, Ind.*

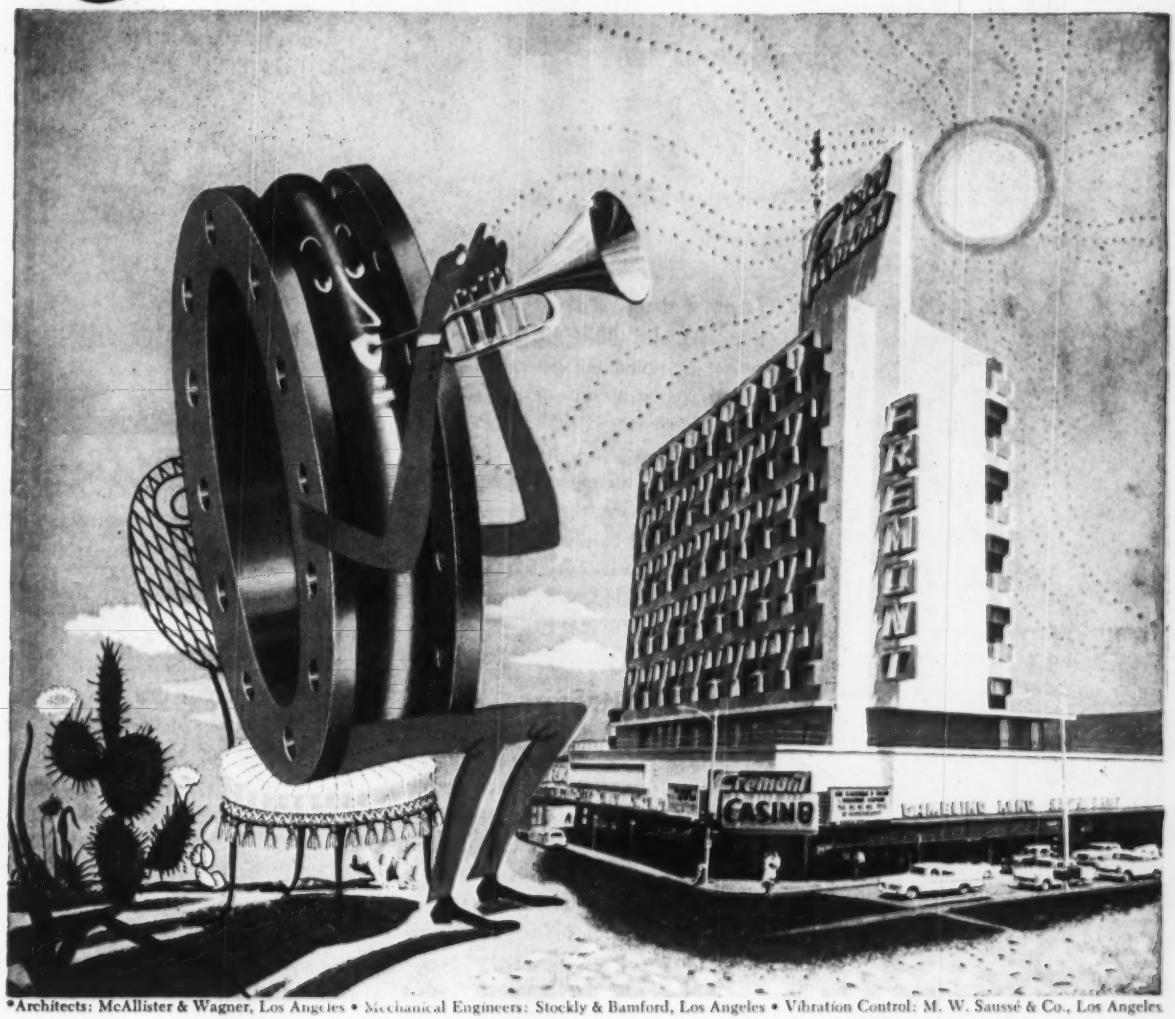
Added to "Flexidyne" line of dry fluid drives and couplings are three larger sizes and a small size for low hp applications. Unit of 18 in. diam available as drive for use with v-belts or as coupling for direct shaft-to-shaft connection. Either will deliver up to 200 hp at 1200 rpm. "22CK" available only as coupling, capable of transmitting up to 800 hp at 1200 rpm. "27CK" is 27 in. coupling with hp rating to 1000 at 900 rpm. For medium light applications 6 in. unit is available as coupling or for use with v-belt drives. It is rated to 2 hp at 1800 rpm.



Horizontal Air Conditioners . . .

. . . designed for commercial applications—*Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC, 505 Carroll St., Brooklyn 15.*

US RUBBER EXPANSION JOINTS



*Architects: McAllister & Wagner, Los Angeles • Mechanical Engineers: Stockly & Bamford, Los Angeles • Vibration Control: M. W. Saussé & Co., Los Angeles

Playing it real cool...at Las Vegas

The revolutionary new cantilevered-floor Hotel Fremont* in downtown Las Vegas is the tallest building in Nevada. Of course, it has the latest in air-conditioning. And that was a big problem to lick.

Subsurface water drainage, plus space-cost considerations, meant that all hotel mechanical equipment had to be located on the 11th floor. Would the air-conditioning pumps transmit vibration to the other floors? Would there be more rattle and roll in the pipes than in the game room?

Not if U.S. Rubber Expansion Joints were installed in the water lines, figured the vibration control engineers who had learned of their efficiency on other jobs. They installed four joints in the system, the first high-pressure, double-duct system used in Nevada. And the Fremont Hotel stays real cool and *quiet*.

These economical, flexible pipe line connections take up the stresses due to vibration, expansion and contraction in water and freon lines. They prevent the transmission of noise, and take care of misalignment. Service life is long because there are no moving parts to wear or bind.

• • •

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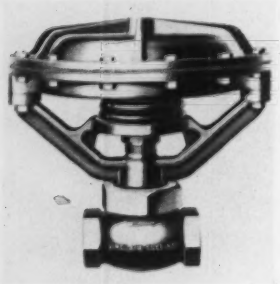
Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

EQUIPMENT DEVELOPMENTS

Continued

Self-contained, air cooled, horizontal air conditioners available in 2, 3, 5 ton models. Compactness, ease of installation are features cited by manufacturer. Units of 2 and 3 ton size measure 24 in. high, 29 in. wide, 49 in. deep. Larger 5 ton model is 30 × 36 × 65. All models may be installed without ductwork.



Three-Way Valve . . .

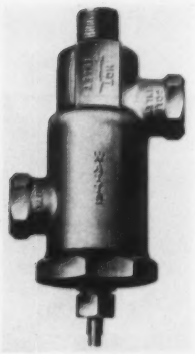
. . . designed for steam, hot and cold water, air and gas service—*Sinclair-Collins Valve Co., Dept. HPAC, 454 Morgan Ave., Akron, Ohio.*

Diaphragm operated ¼ in. NPT 125 psi, three-way "NC" valve has body, yoke, ring, piston of cast Navy M bronze, with cast iron body optional. Disc holders, gland nuts are bar brass, stem is stainless steel, spring is chrome silicon steel. Adjustable stem packers, special composition seats designed to assure leak-free operation in specified service. Valve is added to line of valves in sizes ½ to 3 in.

Steam Meter . . .

. . . modified with addition of pressure compensating counter box — *Builders-Providence, Inc., Dept. HPAC, 345 Harris Ave., Providence 1.*

With addition, "Shuntflo" meter automatically and continuously corrects for pressure variations in the steam line, registering consumption in pounds of steam even when major pressure fluctuations are encountered, says manufacturer. With meters now in service, new feature can be added by replacing standard counter box. Complete unit can be obtained for 1 to 12 in. steam lines.



Tempering Valve . . .

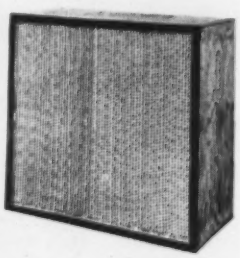
. . . with solid filled hydraulic thermostat designed for powerful action, sensitivity, accuracy—*Watts Regulator Co., Dept. HPAC, 10 Embankment Rd., Lawrence, Mass.*

Especially intended for installation on tankless heaters where direct "hot" line can be piped to equipment without seriously effecting tempered water. "No. 171 Series" valves are adjustable 140 to 200 F.

Forced Air Heaters . . .

. . . with heating capacities 400,000 to 2 million Btu per hr—*Airtherm Mfg. Co., Dept. HPAC, 700 S. Spring Ave., St. Louis 10.*

Units built with elliptical stainless steel combustion chambers, heavy duty blower assemblies, burners capable of operating on oil or gas. Can be installed on floor, suspended from ceiling in horizontal or inverted position. Electronic protection insures positive shutdown in event of power or fuel failure.



Air Filters . . .

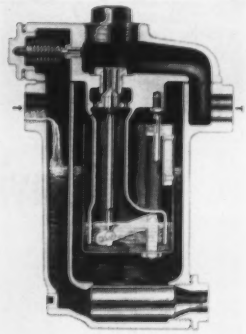
. . . consisting of combination of glass and asbestos fibers—*Cambridge Filter Corp., Dept. HPAC, 738 Erie Blvd., E., Syracuse 3.*

"Absolute" filter is said to have minimum efficiency of 99.97 percent based on removal of 0.3 micron diam particles. Rated capacity of 24 × 24 × 11½ in. size at 1 in. water gage resistance is 1100 cfm. Filters to withstand 1000 F and 100 percent RH available.

Water Treatment . . .

. . . regulator developed to control rust, scale, corrosion, slime, algae in recirculating cooling water systems—*Heller Laboratories, Inc., Dept. HPAC, 124 Fort Lee Rd., Leonia, N. J.*

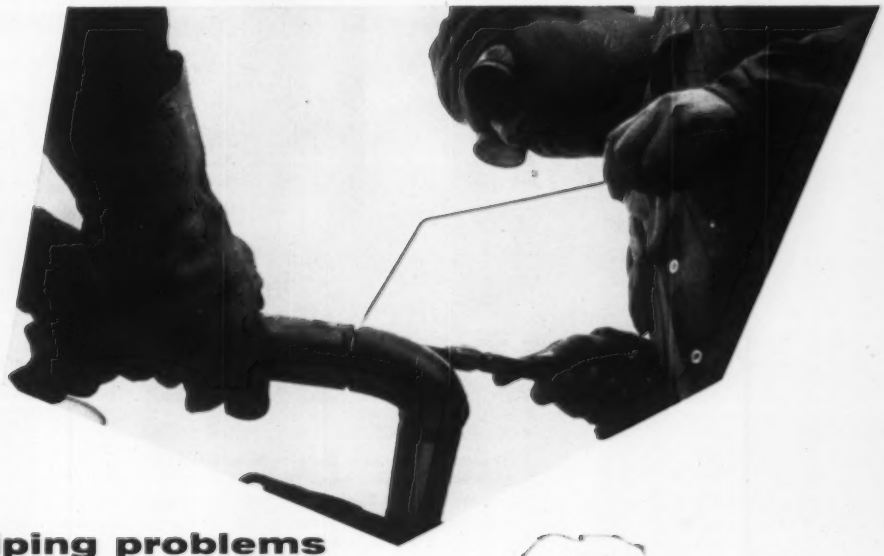
"Hydrotol" is chemical feeder and treatment regulator that automatically, continuously synchronizes rate of chemical feed and water bleedoff with load on system or amount of water evaporated to maintain treatment over long periods of time.



Steam Traps . . .

. . . for varying pressures from zero to 150 psig—*Wright-Austin Co., Dept. HPAC, 3245 Wright St., Detroit 7.*

"500-C" series available in two types: open float and thermostatic. Features cited: faster warmup through efficient venting, discharge of air, condensate in preliminary stage; ability to discharge at 1 and 2 F below steam saturation tem-



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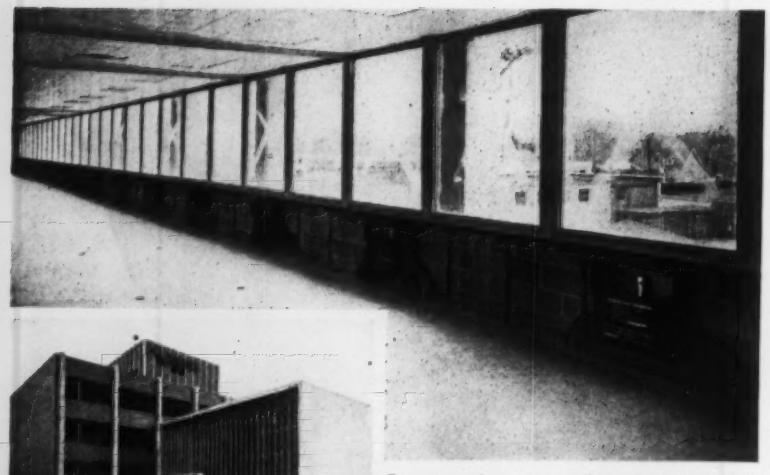


Two connections were easily made to each of 99 underwindow units, even though no two hookups were alike—Colorado Hospital Service and Colorado Medical Service, Inc., Bldg., Denver.

198 different underwindow hookups . . . all easily connected with WIREMOLD FLEXIBLE AIR DUCT

Construction—The exclusive Wiremold construction locks fabric to metal securely. This positive mechanical lock guarantees long life—no adhesives are used.

Problem: This dual-duct system was to be fed through the floor to 99 underwindow units. Since no two connections would be exactly alike, a versatile method for hooking them up was needed. In addition, mechanical vibrations had to be dampened before the air was distributed into the room.

Solution: Wiremold Air Duct. Its flexibility made it easy to make the connection between branch ducts and the units, even where tight bends were required. Its construction also effectively checked vibration.

Light and rugged, Wiremold Flexible Air Duct is so easy to cut, fit, and install that contractors have been thinking of new ways to use it that even we hadn't thought of. Furthermore, under identical conditions, the friction loss of Wiremold is only slightly more than for rigid duct work — normally not enough to require any increase in fan capacity.

FIVE COMMON USES

1. To connect perimeter underwindow units with vertical risers.
2. To connect branch duct to single ceiling outlet.
3. From attenuation box to outlets in modular ceiling.
4. Between branch duct and attenuation box, on the high pressure side.
5. Vertical take-off from branch runout to ceiling pan-type outlet in low and medium pressure systems.

FOR FURTHER INFORMATION SEND FOR FOLDER NO. 591 and DATA SHEET S-11.

WIREMOLD® FLEXIBLE AIR DUCT

THE WIREMOLD COMPANY, HARTFORD 10, CONNECTICUT

EQUIPMENT DEVELOPMENTS

Continued

peratures keeping equipment hotter after initial warmup cycle; accessibility of all parts for service without removal of trap body from line; all working parts monel or stainless steel for corrosion resistance. Available in six models, ½ to 2 in. pipe sizes.

Unit Heaters . . .

. . . in new gas-fired automatic design —*Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago.*

Heaters in new line have capacities from 25,000 to 250,000 Btu per hr input. All models available for use with natural, manufactured, mixed, liquefied petroleum gases; controls for all gases provided as standard equipment. Intended for commercial, industrial applications. Hanger assembly provided for installation; no couplings, unions required to suspend unit with assembly.

Packaged Water Chiller . .

. . . designed for air conditioning, refrigeration installations in 18 to 250 ton capacity range—*York Corp., Dept. HPAC, Roosevelt Ave., York, Pa.*

Units applicable to process cooling, marine refrigeration, chilling of brine, kerosene, machine tool coolants, cutting oils, others. Unit employs company's "V/W" compressor, operated by direct-connected motor (v-belt motor drive also available on packages with 4 or 6 cylinder compressors). Chiller can be piped to cooling tower or evaporative condenser where condensing water consumption should be kept to minimum.

Complete-line air-conditioning lets Worthington dealers

CUSTOM-QUOTE EVERY JOB!

Probably the most complete line of air conditioning equipment in the world—*Worthington, naturally*—is signing on a select group of new air conditioning dealers—*yourself, possibly?*

Many, many different models permit these *fortunate* dealers to put together the most efficient and economical combinations of air conditioning equipment for any *specific* job. Handling *exactly* the right equipment for every air conditioning problem eliminates equipment compromises, means these *smart* dealers can "custom-quote" on every job. And behind this job-tailored equipment stands 70 years of respected Worthington experience and front-line service. (Incidentally, these same *intelligent* new dealers will find that Worthington equipment is backed by a 5-year warranty which includes a generous dealer labor allowance.)

Interested in quoting on equipment fashioned to the job, not jobs fashioned to the equipment? Interested in increasing your sales, cutting down on lost orders? If so, *Worthington wants you—and you'll want Worthington.* Write today for the complete air conditioning story. Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-4, Harrison, N. J.

WORTHINGTON

WORTHINGTON'S COMPLETE COMMERCIAL AND INDUSTRIAL AIR CONDITIONING LINE INCLUDES:

Flexi-cool line: Air-cooled, ceiling-mounted, split systems • Water-cooled, self-contained, ceiling-mounted units • Smallest floor-mounted unit available • Hang it, lay it down, stand it up Vertical and Horizontal cooling coils • Remote water-cooled packaged unit • Water-cooled self-contained packaged unit • Air-cooled packaged units • Air-cooled condensers • Air-cooled condensing units • Packaged water-chillers—hermetic and open • Reciprocating compressors • Air handling units • Evaporative coolers • Evaporative condensers • Fan and coil units

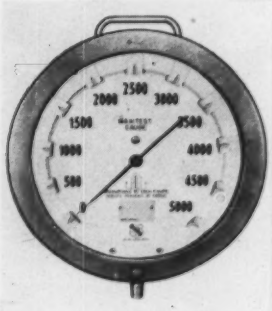
EQUIPMENT DEVELOPMENTS

Continued

Electronic Air Cleaners . . .

. . . with all parts, including selenium rectifiers, guaranteed for five years —*Electro-air Cleaner Co., Inc., Dept. HPAC, Olivia and Sproul Sts., McKees Rocks, Pa.*

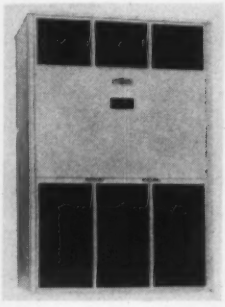
"Series 300" is new addition to "Compact Line" of electronic air cleaners in 15 models and 10 capacities, ranging from 800 to 9600 cfm. Unit's ionizing-collecting cell uses inside curve on face of negative electrodes, providing maximum area of electron discharge. Plate spacing reduced by 5/16 in. to increase intensity of electrostatic field between collecting plates.



Test Gage . . .

. . . with movable dial graduation tabs —*Manning, Maxwell & Moore, Inc., Dept. HPAC,* 250 *E. Main St., Stratford, Conn.*

"Maxitest Type 1080" intended for testing pressure instruments to 10,000 psi, zero to 30 in. vacuum and 15 psi or 30 psi and 30 in. vacuum compound. Available only in 8 in. dial size. Movable tabs replace graduations on dial, bear graduation markings on both sides of exact reading mark. They indicate deviations from standard reading in terms of percent of total error.



Air Conditioning Unit . . .

. . . developed for stores and offices— *Stewart-Warner Corp., Dept. HPAC,* 1826 *Diversey Pkwy., Chicago* 14.

Two new models available as free standing or horizontal ceiling suspended units. Free standing and horizontal models can be used as direct cooling unit or may be ducted. Free standing units available as air or water cooled units in 2, 3, 5 hp

Another
CAINS
COIL OF PROFIT
INSTANT-VANE RAIL
ELIMINATES
Layout—Tab Cutting—Hole Punching —Spot Welding—Riveting—Etc. Results in a Savings Up to 70% over old methods.
Best method ever devised for installing Turning Vanes (single or double) in sq. elbows. In coils. Pull out, shear off—insert vanes and peen with hammer. No valuable time lost.
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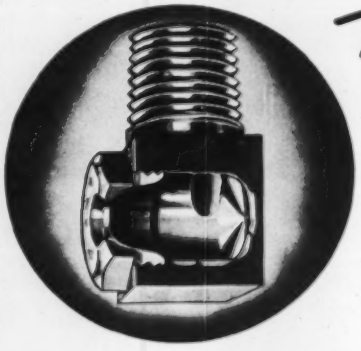

Monarch

NOZZLES for AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

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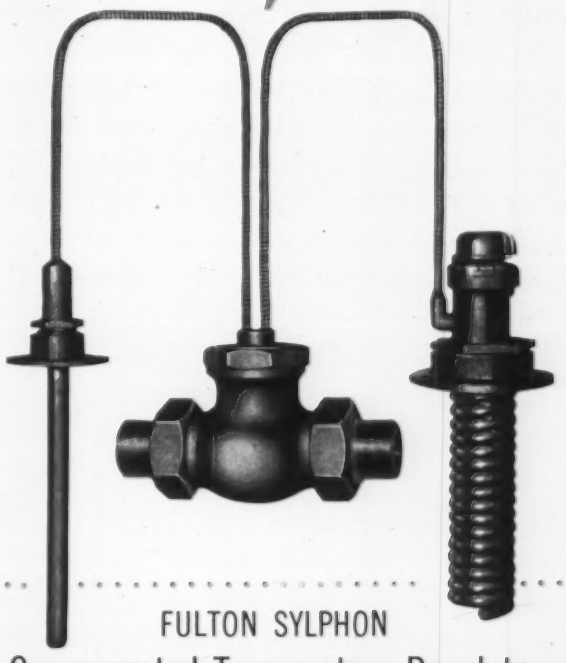

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Compensated Temperature Regulator

CONTROLS HEATING AND VENTILATING SYSTEMS

These low-cost single valve regulators provide dependable modulating control of heating and ventilating systems. An even discharge air temperature is maintained, irrespective of demand. Control bulb automatically adjusts to prevent "droop" when a constant discharge temperature is wanted. All Sylphon No. I-928 Series regulators are self-powered and feature premium quality packless valve construction. 60° temperature ranges between 0°F and 170°F. Sizes—½" to 2". Write for complete data on No. I-928 Series Temperature Regulators. Ask for Catalog D-PH.

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redesigned
BONNEY THREDOLETS

IMPROVED FORGING TRIM AVOIDS NOTCH EFFECT, ENHANCES APPEARANCE

THICKER WALL PREVENTS THREAD DISTORTION CAUSED BY WELDING

FULL PENETRATION WELD ASSURED BY SHARPER LAND ON WELD BEVEL

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REDUCED WELDING SPEEDED INSTALLATION —RESULTING FROM CHANGED SHAPE, CLARIFYING WELDLINE WITH SHARPENED BEVEL

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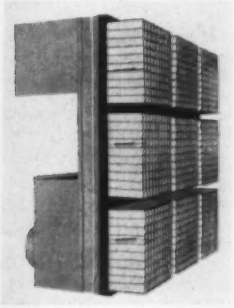
CARBON STEEL
STAINLESS
ALLOY
for all services

BONNEY FORGE AND TOOL WORKS
DEPT. C ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS

Continued

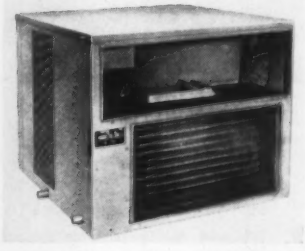
models, are used with remote condensing units of corresponding capacities. Models of 7½ hp are air cooled only, have cooling capacity of 84,000 Btu per hr, require three phase outlet.



Air Filter . . .

. . . with two stage disposable media —*Farr Co., Dept. HPAC, P. O. Box 45187, Airport Sta., Los Angeles 45.*

"Hi-Kleen" consists of automatic primary filter, combined in series with bank of filters as afterfilter. Units may be joined to handle any cfm requirements. Although designed to operate at air velocity of 500 fpm, filter will remain effective down to 350 fpm. Unit contains gear motor.



Air Conditioning Units . . .

. . . for industrial, commercial applications—*Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

Line of self-contained, air cooled, central air conditioners includes two 2 hp units, two 3 hp units, one 4 hp unit. Models cover capacity range 19,700 to 40,000 Btu per hr. Units can be used with existing warm air ducts or as separate system, require no water nor plumbing connections. Dimensions of 4 hp model: 59½ × 32 × 24 in.

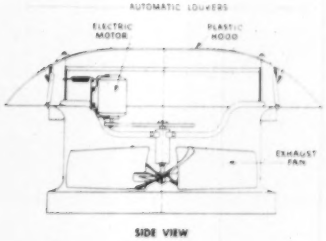
EQUIPMENT DEVELOPMENTS

Continued

Packaged Air Conditioners

. . . designed for small commercial applications—*Westinghouse Electric Corp., Dept. HPAC, Box 2278, Pittsburgh.*

Two watercooled additions to "Matchmaster" line of air conditioners rated at 43,000 and 60,500 Btu. Units have outdoor condensing coil and evaporator coil; may be installed in existing ductwork.



SIDE VIEW

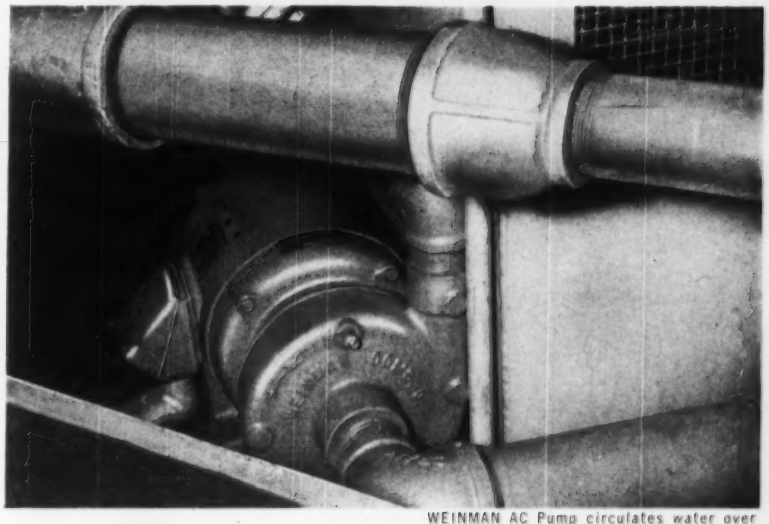
Roof Ventilator . . .

. . . designed to ventilate, illuminate interior of building—*Consolidated General Products, Inc., Dept. HPAC, 24th and Nicholson Sts., Houston 8.*

Ventilator has glass fiber reinforced plastic hood. Translucent dome passes two-thirds outside light. Shatterproof plastic hood is resistant to atmospheric, chemical corrosion. Ventilator fan, sheathed by galvanized steel housing, is powered by electric motor equipped with automatic thermal overload out-off switch. Counterbalanced, gravity operated automatic louvers beneath plastic hood control air flow. Louvers fitted with nylon bearings. Available in 18 sizes with fans 24 to 48 in. diam; plastic hoods 45 to 80½ in. square. Units weigh 127 to 335 lb.

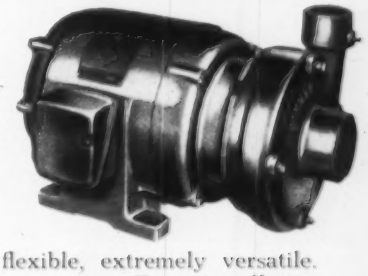
(*Continued on page 185*)

ONE WEINMAN TYPE AC PUMP INSTALLED . . .



WEINMAN AC Pump circulates water over cooling tower for 20-ton air conditioning unit at General Electric Supply Co., Columbus, Ohio

all air conditioning pumping worries over!



Hot and chilled water circulation through cooling towers, condensers or heating systems . . . pressure boosting . . . and many other general *and* specialized pumping needs can be solved quickly, efficiently and economically with WEINMAN Type AC Unipumps.

These pumps are highly flexible, extremely versatile. Installation is simple and inexpensive. Even installation in confined areas is easy because of the flexible mounting features of this compact pump. WEINMAN Type AC Pumps can be *mounted in any position* on floor, ceiling or wall, with the shaft horizontal, vertical or at an angle.

WEINMAN Type AC Unipumps are Close Coupled . . . single stage . . . single suction . . . have output ratings to 260 gpm . . . heads to 150 feet . . . a horsepower range from ¼ to 7½ !

Your nearest WEINMAN PUMPS SPECIALIST can give you full information on *all* WEINMAN Pumps. Call him . . . you'll find his name listed in the yellow pages of your phone book.

It will pay you to get the full story about WEINMAN *Type AC Unipumps. Today . . . write for your free copy of* WEINMAN'S *illustrated Bulletin No. 100 showing dimensions, specifications, features, selection table and performance curves.*

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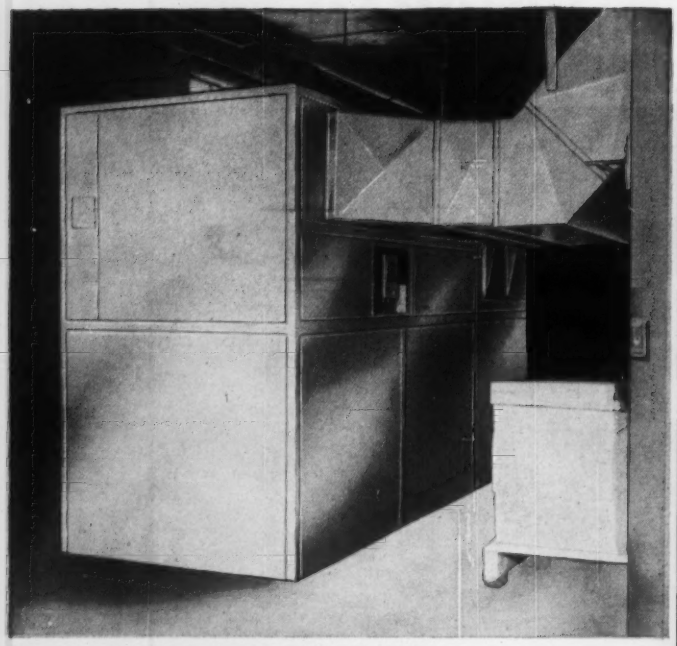
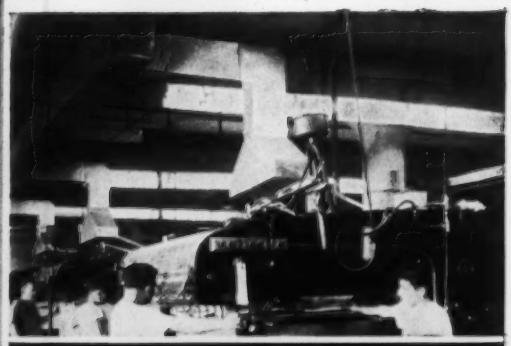
Centrifugal Specialists





Engineers and Contractors: Tryon, Inc., Springfield, Mass.

SIMPLE TO SPECIFY...
SIMPLE TO INSTALL...
pre-engineered 'CPU' Air Conditioning Package

by DUNHAM-BUSH

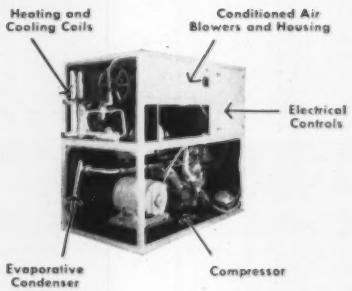
Proper control of humidity is an important consideration in a printing plant. At General Offset and Printing Company in Springfield, Mass. the decision was made to air condition the paper storage area, pressroom and "stripping" room.

Once this had been decided, top management executives naturally wanted the installation made quickly.

A Dunham-Bush 'CPU' Pre-Engineered air conditioner was selected. This unit is a complete air conditioning *system* housed in one cabinet—containing evaporator, compressor, evaporative condenser and pump, fans, motors, piping and controls.

Installation required only connection of power supply to control panel, connection of water make-up line and necessary duct connections.

For your next air conditioning job, why not eliminate specification and installation worries by selecting a Dunham-Bush 'CPU' Commercial Package Unit.



Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

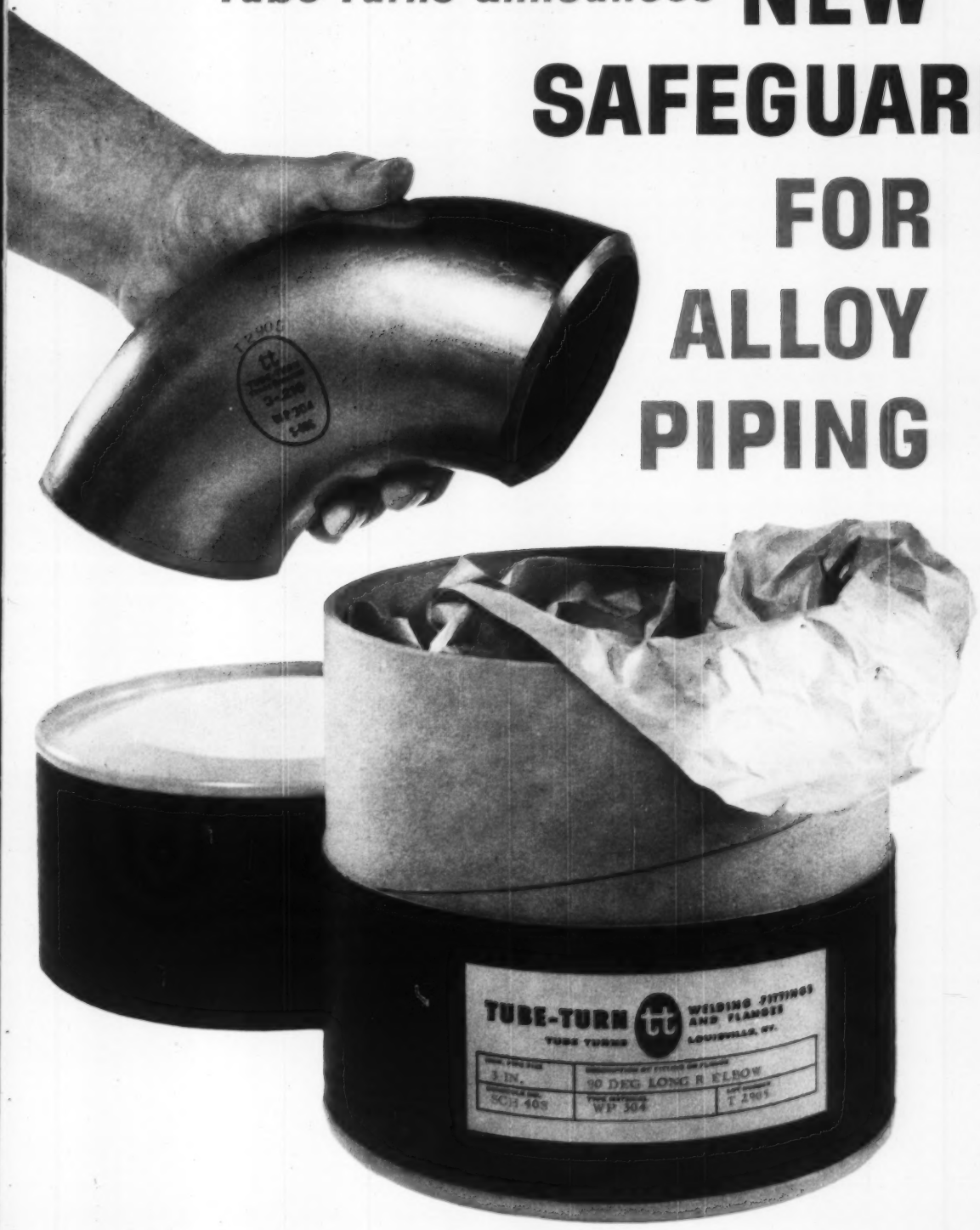
AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA • MARSHALLTOWN, IOWA
RIVERSIDE, CALIFORNIA • UTICA, NEW YORK

SUBSIDIARIES

heat-x HEAT-X, INC. BROCKTON, N.Y.
BRUMER THE BRUMER CO. GAINESVILLE, GA.
Dunham-Bush DUNHAM-BUSH (CANADA), LTD. TORONTO, CANADA
Dunham-Bush DUNHAM-BUSH, LTD. LONDON, ENGLAND
BRUMER BRUMER CORPORATION (CANADA), LTD. PORT HOPE, ONTARIO

Tube Turns announces **NEW SAFEGUARD FOR ALLOY PIPING**



For details, turn the page...

NOW...individual packaging protects each TUBE-TURN® Alloy Welding Fitting and Flange

AVAILABLE IN...

STAINLESS STEELS	COPPER
ALUMINUM ALLOYS	SILICON BRONZE
NICKEL	RED BRASS
MONEL	ADMIRALTY METAL
INCONEL	TITANIUM
HASTELLOY B & C	ZIRCONIUM
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on TUBE-TURN Alloy Fittings and Flanges

TUBE TURNS
224 E. Broadway, Louisville 1, Kentucky
Please send me bulletins on these fittings and flanges:
☐ Alloys ☐ Stainless Steel ☐ Aluminum

Company Name _____
Company Address _____
Your Name _____
Position _____
City _____ Zone ____ State _____

Your nearby Tube Turns' Distributor can supply your fitting needs in alloys and non-ferrous metals . . . as well as in carbon steel, wrought iron, carbon-moly and chrome-moly. This one source for all your requirements in welding fittings and flanges enables you to simplify purchasing and cut red tape.

Tube Turns is now safeguarding the top quality of its stainless steel, aluminum and other alloy products with individual packaging. All of these fittings in sizes through 12", and flanges through 8", are now wrapped in kraft paper and individually packaged in a rugged container, built to standards established by extensive testing. Hence, from point of rigid inspection to job site, *each* fitting is *protected* against damage.

Here is new *convenience*, too. Your fittings are easier to store. And each container is fully marked with description of fitting or flange, size, schedule, type material and production lot for positive, easy identification in the warehouse or on the job.

Here is another plus value you get when you specify TUBE-TURN* Alloy Fittings and Flanges, and buy them from your nearby Tube Turns' Distributor.

The trademarks "TUBE-TURN" and "tt" are applicable only to the quality products of Tube Turns.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

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IN CANADA: Tube Turns of Canada Limited, Ridgetown, Ontario. DISTRICT OFFICES: Toronto, Ontario • Edmonton, Alberta • Montreal, Quebec • Vancouver, British Columbia

CHEMETRON

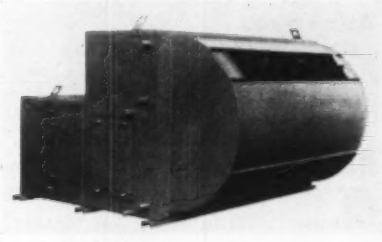
EQUIPMENT DEVELOPMENTS

Continued from page 181

Pipe Insulation Jacket . . .

. . . developed to facilitate enclosure of right angle turns in insulated pipelines—*Aluminum Co. of America, Dept. HPAC,* 1501 *Alcoa Bldg., Pittsburgh* 19.

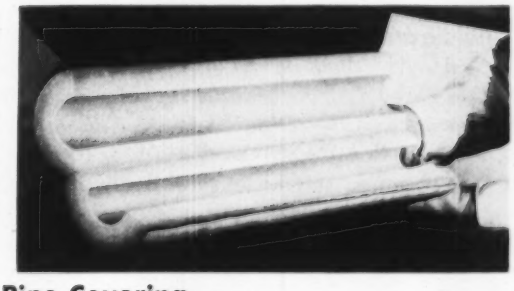
Aluminum elbow has almost squared-off rather than rounded contour, providing space to fit both sharp or curving turns without cutting away insulation. Manufactured in 12 diameters to fit 107 combinations of pipe diameters, insulation thicknesses to 12.81 in. OD.



Air Handling Unit . . .

. . . with vibration isolation feature—*Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC,* 3301 *Medford St., Los Angeles* 63.

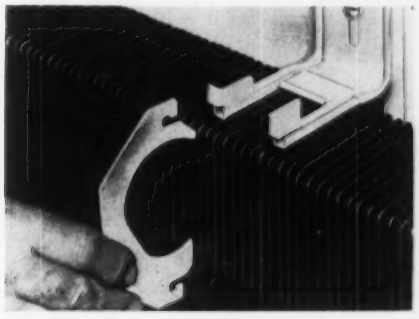
High pressure hot and cold deck air handling unit has following features cited by manufacturer: dual forward curve fans; internal vibration isolation of fans and motors; high pressure construction; diffusers designed to give even air distribution over coil face. Horizontal or vertical discharge available. Housing is 14 gage galvanized steel with three oversize access doors. Panels are removable. Capacities range 5000 to 25,000 cfm.



Pipe Covering . . .

. . . intended for insulating hot and cold water piping, low-pressure steam lines, refrigerant lines—*Ehret Magnesia Mfg. Co., Dept. HPAC, Valley Forge, Pa.*

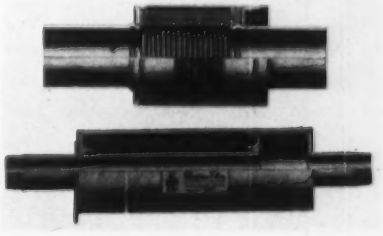
"Therma-K" glass fiber pipe cover has low thermal loss (0.25 Btu per sq ft per hr) at 100 F mean, is lightweight (densities 0.15 to 2 lb per cu ft). Available in 3 ft sections, hinged to open, close around pipe; supplied in range of wall thicknesses for iron pipe sizes $\frac{1}{2}$ to 12 in., copper tubing $\frac{1}{2}$ to 3 in. Canvas jackets, vapor barrier jackets, waterproof jackets, general purpose jackets available for covering pipe insulation.



Wall Radiation . . .

. . . designed for use in commercial, industrial, educational, institutional, church, hospital, government buildings—*Fedders-Quigan Corp., Dept. HPAC,* 58-01 *Grand Ave., Maspeth, N. Y.*

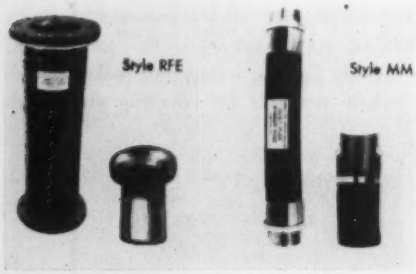
Besides heating elements, "Modernline" unit consists of backplate assembly, universal pipe hangers, cover assembly. Backplate is made of 20 gage steel; cover uses 16 gage steel, also available in 14 gage. No raw metal edges in assembly. "Modernline" can be obtained in 4 in. increments to maximum length of 8 ft with or without damper. May be combined with variety of 1, $1\frac{1}{4}$ in. copper and aluminum elements, $1\frac{1}{4}$, 2 in. all steel elements.



Expansion Joints . . .

. . . designed to absorb expansion, contraction in pipelines—*Fulton Sylphon Div. of Robertshaw-Fulton Controls Co., Dept. HPAC, Box* 400, *Knoxville* 1, *Tenn.*

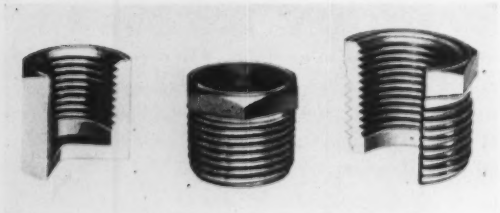
Three new packless expansion joints are said by manufacturer to meet requirements in high and low pressure applications and situations where corrosive materials are being transported. "Model 1290" suitable for use in steam and hot water lines under low pressure. "Model 1291," equipped with stainless steel bellows, has working pressure of 150 psig. "Model 12139-R" made entirely of stainless steel. Maximum operating temperature 1000 F; maximum operating pressure 700 psig.



Rubber Pipe . . .

. . . designed to dampen noise, vibration, pulsations in water lines—*Vibration Mountings, Inc., Dept. HPAC, 98-15 50th Ave., Corona 68, N. Y.*

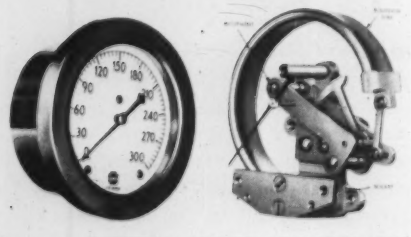
"Quiet-Flex" rubber pipe consists of inner tube of pure gum rubber or specially compounded synthetic stock, which is protected by wire-reinforced flexible carcass of multiple plies of square woven duck and rubber, covered with outer wrap. Designed to withstand continuous operating temperatures to 180 F. Special heat resisting hose sections are available for temperatures to 250 F. Rated working pressures vary with type to 250 psi. Available in two designs: "RFE" and "MM."



Pipe Fittings . . .

. . . including hex bushings, caps, plugs—*H. K. Porter Co., Inc., Dept. HPAC, 300 Park Ave., New York 22.*

"W-S commercial" fittings suitable for 300 psi steam at 555 F. High quality in threads, alignment, concentricity, says manufacturer.



Pressure Gages . . .

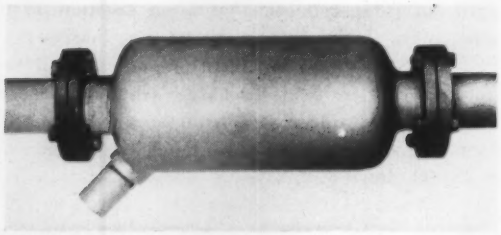
. . . with design improvements in accuracy, case styles, movements, bourdon tubes, optional extras—*United States Gauge Div. of American Machine and Metals, Inc., Dept. HPAC, Sellersville, Pa.*

"A-Line" intended for use in power and steam plants, refrigeration systems, metal working industries, hydraulic presses, other industrial applications where steam, water, noncorrosive oils, gases are principal measured media. Guaranteed accuracies within 1 percent of scale range for middle (working) half of scale. Socket, tube, tip, movement, dial, pointer removable as one unit. Available movements include deepbrushed brass and all stainless steel and nylon stainless steel. Bourdon tubes in phosphor bronze, 403 or 316 stainless steel. Pressure range from 10,000 psi gage to 30 in. Hg. vacuum.

Duct Adhesives . . .

. . . especially formulated for bonding insulation to metal ducts—*Cain Mfg. Co., Dept. HPAC, 1111 Fifth Ave., N., Birmingham, Ala.*

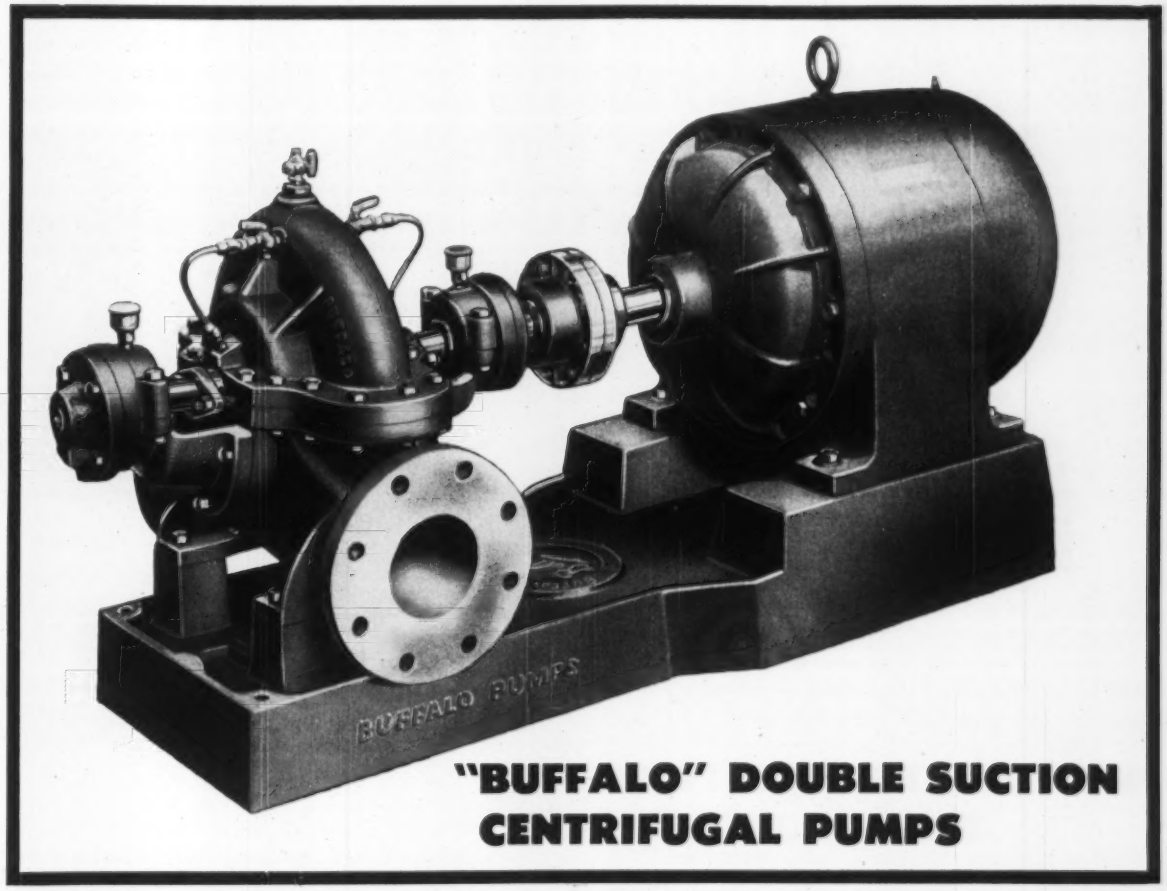
Two products available: "Fastak" and "Ductak." "Fastak" is waterproof, gives 230 sq ft per gal by brush, 270 sq ft per gal by roller application. Temperature range: −30 to 325 F for blanket; −30 to 250 F for board. According to manufacturer, "Ductak" has all features, qualities of other product, except for slightly longer setting time required. One hour necessary before ducts may be brake-formed without danger of breaking bond.



Line Separator . . .

. . . designed to eliminate entrainment from vapor and process lines—*A. C. S. Industrial Div., American Copper Sponge Co., Inc., Dept. HPAC, 71 Villanova St., Woonsocket, R. I.*

Line separators may be installed directly in operating line horizontally or vertical upward. Units utilize knitted wire mesh for entrainment removal. Use expansion impingement, change of direction liquid scrubbing for more complete separation of liquid and vapor. Cases normally constructed of carbon steel, but also available in stainless steel; elements are of 304 stainless steel standard, also available in 316, monel, nickel, if required.



"BUFFALO" DOUBLE SUCTION CENTRIFUGAL PUMPS

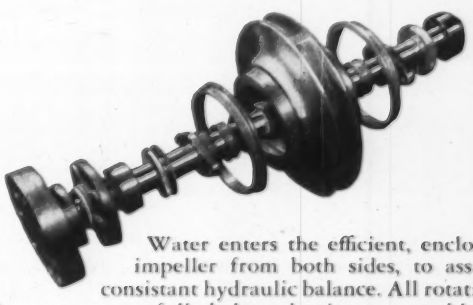
OFFER MORE FOR YOUR PUMP DOLLAR

- **Long Life**
- **High Efficiency**
- **Quiet Operation**
- **Reliability**
- **Minimum Down Time for Repairs**
- **Availability of Replacement Parts**

"Buffalo" Pumps' engineering and rugged, dependable construction make them highly desirable for demanding industrial service. For example, "Buffalo" Double Suction Pumps for dependable clear water service feature precision-machined casings with ample water passages — impellers designed for highest efficiencies — bronze wearing rings — sturdy shafts and heavy-duty ball bearings.

The complete line of "Buffalo" Double Suction Pumps, in capacities from 10 to 14,000 gpm, assures the pump that's tailored to *your* clear water moving needs — *exactly*. For full information, contact your nearby "Buffalo" Engineering Representative, or write for Bulletin 955-R.

Value Beneath the Surface . . . the impeller and shaft assembly of the "Buffalo" Double Suction Pump.



Water enters the efficient, enclosed impeller from both sides, to assure consistant hydraulic balance. All rotating elements are carefully-balanced prior to assembly.

The value "bonus" in every "Buffalo" Pump is the "Q" Factor — the built-in QUALITY which assures trouble-free satisfaction and long life.

"Buffalo" PUMPS

BUFFALO PUMPS

DIVISION OF BUFFALO FORGE CO.

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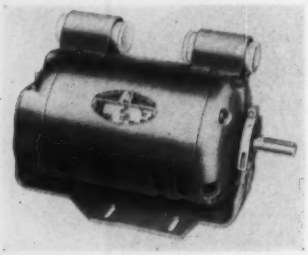
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

EQUIPMENT DEVELOPMENTS

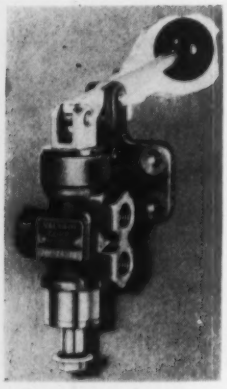
Continued



Motors . . .

. . . incorporating reservoirs, feed devices designed to admit oil to sleeve bearings in controlled quantity after original bearing lubricant is expended —*Franklin Electric Co., Inc., Dept. HPAC, 400 E. Spring St., Bluffton, Ind.*

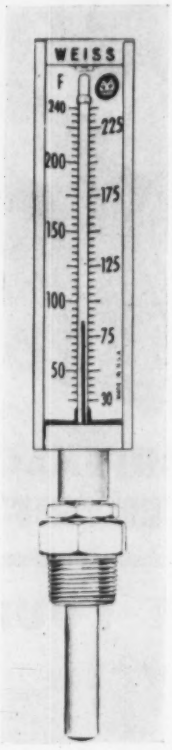
Supply of proper lubricant contained in visual reservoirs mounted on motor end bell. Oil retained in reservoir by means of mechanical stopper, permitting normal handling prior to installation without loss of lubricant from reservoir, eliminating lubricant loss due to prolonged shelf life. At set length of time lubricant is discharged to bearing cavity. As oil is discharged from wick cavity, it is replaced by fresh oil from reservoir. Available in 1/3 to 1½ hp ratings in dripproof, open, totally enclosed construction, with or without capacitor. Motors offered to manufacturer's requirements in additional ratings, types.



Manual Valves . . .

. . . for ceiling mounting behind or below control panels —*Valvair Corp., Dept. HPAC, 454 Morgan Ave., Akron 11, Ohio.*

Lever-actuated manual valves provide unrestricted flow capacity, have straight-through construction. Valve bodies are one piece Navy M bronze with chrome-plated stainless steel stems. Packers said to be unaffected by air, oil, grease, water. Flow area through valves equal to nominal pipe size.



Thermometer . . .

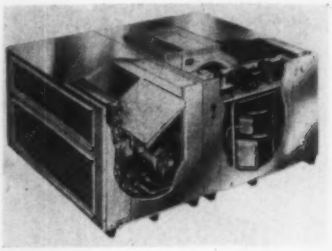
. . . intended for diesel engines, compressors, brine lines, small piping networks—*Albert A. Weiss & Son, Inc., Dept. HPAC, 261 Vanderbilt Ave., Brooklyn 5.*

Red-reading mercury in glass tube of 5 in. thermometer gives accurate readings even under vibration and shock conditions, says manufacturer. Thermometer's case, of extruded brass, has one piece construction. Stem assembly has standard fittings of all brass construction. Sockets available in all metals.

Clock System . . .

. . . developed for use in commercial, industrial, public buildings—*Minneapolis-Honeywell Regulator Co., Commercial Div., Dept. HPAC, 2747 Fourth Ave., S., Minneapolis, Minn.*

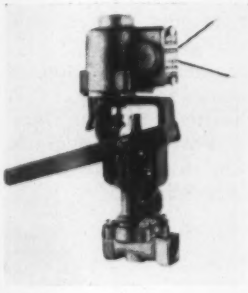
System includes master clock and any number of secondary clocks located throughout building. Also included is programmer to break electrical circuit at specified intervals to sound bell, start or stop heating and air conditioning equipment or turn lights on or off. Programmer sequence can be changed by hand without special tools.



Heat Pump . . .

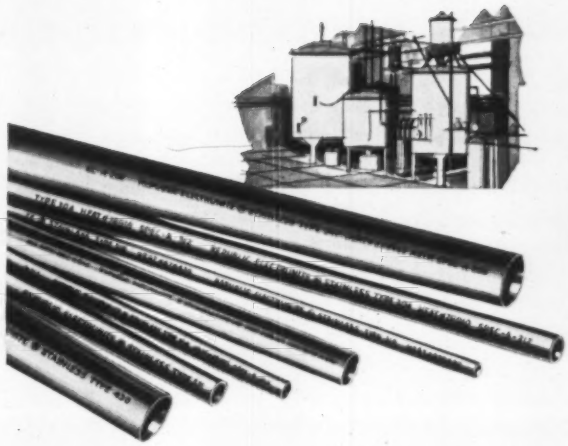
. . . in horizontal model designed for flexibility in installation—*Lennox Industries, Inc., Dept. HPAC, Marshalltown, Ia.*

Indoor, outdoor sections of heat pump may be close-coupled for single package. May be installed on flat roof of commercial buildings or outside at foundation line. Compressor in unit has oversize motor with refrigerant motor cooler. Operates with condensing temperatures to 145 F, with evaporator temperatures below zero. Models range from 3 to 5 tons cooling capacity, from 12,500 to 21,500 Btu per hr heating capacity (less strip heaters) at zero F outdoor temperature.



Three-Way Valve . . .

. . . designed to handle air, gas, oil, water, etc. at temperatures to 212 F —*Automatic Switch Co., Dept. HPAC, Florham Park, N. J.*



wide range of sizes solve installation problems . . .

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STAINLESS STEEL TUBING AND PIPE

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Avoid costly delays and down time. Your Republic ELECTRUNITE® distributor—your local steel service center—offers one-order service, fast delivery of Republic ELECTRUNITE Stainless Steel Tubing and Pipe in a wide range of sizes.

Produced by Republic—world's leading producer of alloy and stainless steels—in Republic mills to Republic's rigid specifications, ELECTRUNITE is welded by an exclusive process that unites the wall under pressure without additional foreign or extra metal. Tests prove the ELECTRUNITE weld is as strong as, or stronger than, the original base metal.

"*All ELECTRUNITE Stainless Steel Pressure Tubing and Pipe is fully solution annealed for maximum corrosion resistance.*"

ELECTRUNITE is easy to install—can be welded, threaded, or used with compression fittings. ELECTRUNITE assures uniformity of wall thickness, strength, ductility, concentricity, diameter, and other physical and mechanical properties for dependable, predictable workability.

Pipe sizes are available from ⅛" through 2" I.P.S. in A.S.A. schedule 40S; from ⅛" through 4" I.P.S. in A.S.A. schedule 10S; and from ½" through 4" I.P.S. in schedule 5S wall thicknesses. Tubing is available in sizes from ¼" O.D. to 5" O.D. with wall thicknesses of .020" to .165" (depending on the O.D. size of tube). Larger tube and pipe sizes up to 40" O.D. are also available. Each full length is continuously stenciled with type, heat number, and specification for easy identification no matter where it's cut. ELECTRUNITE Stainless Steel Tubing can also be furnished with I.D. polished, O.D. polished, or both, to meet any sanitary requirement.

Keep your men on the job and customers happy. Call your Republic ELECTRUNITE steel service center for the *right* stainless steel tubing or pipe to meet your specific requirements. Or, send coupon for more information.

ALABAMA
Industrial Piping Supply Co., Bessemer

CALIFORNIA
Ducommun Metals and Supply Co., Los Angeles
Earle M. Jorgensen Co., Oakland
TUBESALES, Los Angeles

CONNECTICUT
Peter A. Frasse and Co., Inc. Hartford

GEORGIA
Atlantic Steel Company, Atlanta
McJunkin Corp., Atlanta

ILLINOIS
Chicago Steel Service Co., Chicago
Chicago Tube and Iron Co., Chicago
Creamery Package Co., Chicago (Sanitary Tubing only)

KENTUCKY
McJunkin Corp., Louisville
Williams and Company, Inc. Louisville

MARYLAND
Hill-Chase Steel Co. of Maryland Baltimore

MASSACHUSETTS
Springfield Plumbing Supply Co., Springfield

MISSOURI
Marsh Steel Corp., North Kansas City

NEW JERSEY
A. B. Murray Co., Inc., Elizabeth

NEW YORK
W. A. Case & Son Co., Inc., Buffalo
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K. & S. Metal Supply, Inc., Long Island City

OHIO
McJunkin Corp., Columbus
Williams and Co., Inc., Cincinnati
Williams and Co., Inc., Cleveland
Williams and Co., Inc., Columbus
Williams and Co., Inc., Toledo

PENNSYLVANIA
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Hill-Chase and Co., Philadelphia
A. B. Murray Co., Inc., Bristol
A. B. Murray Co., Inc., McKeesport
Williams and Co., Pittsburgh

TENNESSEE
Vance Iron and Steel Co., Chattanooga

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The Baldwin Co., Houston
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Please send me additional Republic ELECTRUNITE Stainless Steel Tubing and Pipe information.

Name_____ Title_____

Firm_____

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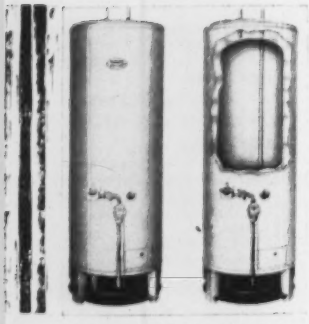
City_____ Zone____ State_____

EQUIPMENT DEVELOPMENTS

Continued

Valve has forged brass body, cast iron operating mechanism, soft composition disc. Two types of operation: no voltage release; electrically tripped. Intended for use whenever requirements call for valve to be manually set and held in one position, then electrically returned to original position. Available in ½, ¾, 1 in. NPT, a-c or d-c voltages and general purpose, watertight, explosionproof enclosures.



Commercial Water Heater

. . .with solid copper tank encased in steel shell—*Trageser Copper Works, Inc., Dept. HPAC, New York International Airport, Jamaica* 30, *New York.*

"COM-65" is a 65 gal unit with an input of 100,000 Btu for natural, manufactured and mixed gases, recovers 84 gph at 100 F temperature rise. Copper core tested to pressure of 450 psi, suitable for working pressures to 191 psi. Unit has no tubes. Tank is covered with glass fiber insulation.

Industrial Tape . . .

. . .designed for wide diversity of uses—*United Mineral & Chemical Corp., Dept. HPAC,* 16 *Hudson St., New York, N. Y.*

"Tesamoll" tape is urethane plastic foam backed by pressure sensitive adhesive, protected by tissue. Insulates heat, cold, has sound deadening characteristics, says manufacturer. Resistant to oils, most chemicals, is waterproof. Available in following colors: cream white, green, gray, brown, black.

Pipe Locator . . .

. . .powered by transistors—*Gardiner Electronics Co., Dept. HPAC,* 2545 *E. Indian School Rd., Phoenix, Ariz.*

New pipe locator and metal detector uses 8 transistors: 1 in transmitter, 7 in receiver. Uses only 4 flashlight batteries: 2 in transmitter, 2 in receiver. Has maximum range of 21 ft. Housed in metal box with baked paint finish, printed circuits.

Brass Valves . . .

. . .designed to provide high efficiency, low maintenance characteristics—*Air Reduction Sales Co., Equipment Manufacturing Plant, Dept. HPAC, Clermont Terrace, Union, N. J.*

Forged brass high pressure valves available in following types, sizes: "Master Valve" 3000 psi in sizes ½ and ⅜ in.; "Non-Return Shut-Off" 250 psi in sizes ½, 1 in.; "Pneumatic Electric" 150 psi in 1 in. size. Recommended by manufacturer for use in high pressure gas piping systems.

Plastic Pipe Fittings . . .

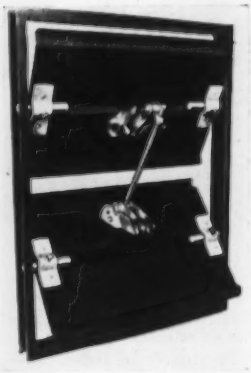
. . .designed for toughness, light weight—*Plastiline, Inc., Dept. HPAC, White Plains, N. Y.*

Corrosion resistance of "Plaskon Nylon 8200" said to be superior to conventional metal fittings. Recommended applications; jet well installations, industrial piping, air conditioning. Adapters, couplings, tees, elbows available in sizes ½ to 2 in.

Concrete Drill . . .

. . .developed to drill holes to 14 in. diam through reinforced concrete at 4 in. per min—*Molco Drilling Machines Inc., Dept. HPAC,* 1110 20*th St., N. W., Washington, D. C.*

"Mole Model V" gasoline powered diamond core drilling machine, is equipped with 15 hp engine, 12 volt generator, starter, clutch, governor mounted on steel base. Unit also includes water pump, water swivel. Two speed drill bit feed mechanism cuts drilling time, says manufacturer. Unit is portable, mounted on truck or weighted vehicle.



Damper Linkage Set . . .

. . .developed to accurately operate damper blades of all sizes in common use—*Duro-Dyne Corp., Dept. HPAC, Farmingdale, N. Y.*

"Opax" linkage set consists of two brackets and pre-attached linkage rod, incorporating "Neva-Bind" action which provides four way self-adjustability for construction inaccuracies, prevents binding, reduces assembly time to minimum.

Shop Welder . . .

. . .for sheet metal, heating, piping, air conditioning shops—*Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy* 1, *Ohio.*

"Hustler" can be used for cutting, welding, hole burning, hard surfacing, soldering, brazing, heating metal for bending and forming. Unit is

"SPANGRID *Steel Pipe...pre-cut to our specifications...*
SAVED US 133 MAN-HOURS!"

Says Robert B. Anderson, President of R. B. Anderson, Inc., mechanical contractor for Karan Corporation Building, Denver, Colorado

"SPANG helped us where it counts . . . in savings of time and money," states Mr. Anderson. "The problems my company faced on the Karan radiant heating job are universal: to meet the job specifications and deadline and yet keep costs down. Thanks to SPANG we did just that. SPANG gave us swift delivery of the entire order—10¼ miles of SPANGRID Steel Pipe, pre-cut to non-standard lengths.

Spang Supplied Special Pipe Lengths

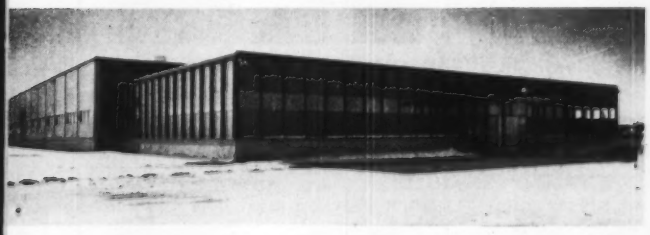
"What impressed me," says Mr. Anderson, "was SPANG's ability to deliver their one-inch in lengths of 38 feet. If we had been able to get only the standard length—21 feet—we would have had to make 800 extra welds. This saved us approximately 133 man-hours, or $465.00.

Fast Service From Spang

"SPANG delivered our entire order of CW Pipe two weeks ahead of earliest date offered by their competitors. This enabled us to fabricate the entire radiant heating system by the time the general contractors were ready to pour the concrete floor slabs."

You Can Get Top-Quality Service, Too!

Your local SPANG Distributor can give you this same fine service on your SPANG CW Pipe order. SPANG Pipe is manufactured under strict quality-control methods, tested and inspected to assure you of a top-quality product every time. Make it steel pipe—make it SPANG.



Welder is shown assembling the radiant grid coils, which will be imbedded three inches below the surface of a 6 to 8-inch thick concrete slab floor. More than 10¼ miles of SpanGrid Steel Pipe were installed.

Architect: Stark and Kondel, Denver
General Contractor: J. & K. Construction Company, Denver
Mechanical Contractor: R. B. Anderson, Inc., Denver
SPANG Distributor: Great Western Pipe and Supply, Denver

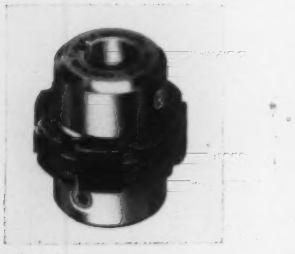
SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
Two Gateway Center, Pittsburgh, Pa.

SPANG®
CW STEEL PIPE

EQUIPMENT DEVELOPMENTS

Continued

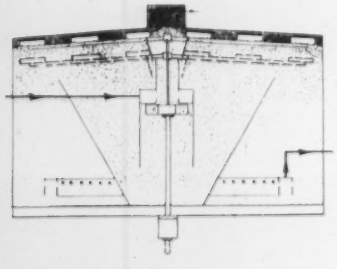
rated at 130 amp at 25 volts on 20 percent duty cycle. Operating voltage is 230 volts single phase, 60 cycles, with tap for 208 line voltage. Standard equipment includes electrode holder, plastic shield, ground clamp, 20 ft electrode cable, 15 ft ground cable, 3 ft power connecting cable, welding electrodes.



Flexible Coupling . . .

. . .in new size—*Certified Flexible Couplings, Inc., Dept. HPAC, 37 N. Bond St., Mount Vernon, N. Y.*

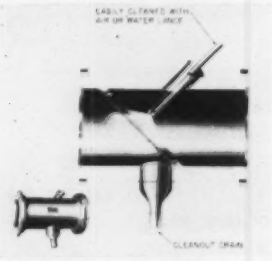
"5R" flexible coupling is for shaft sizes ¾ to 1⅝ in. with every 1/16 in., mm size and combinations inclusive. Coupling is rated for 15 hp maximum at 1750 rpm. Available from stock.



Hydraulic Lifter . . .

. . .engineered to speed up sludge removal in water conditioning units—*Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York.*

Overload control for slurry clarifiers available for use with "Graver Reactivator." Overload control is hydraulic lifter on sludge scraper shaft which operates when heavy sludge prevents normal rotation of scrapers. Lifter raises scrapers 12 in. or more—depending on volume of sludge. Hydraulic pump, valve system activates lifter. Pump can be operated manually or by motor. Motor may be initiated automatically or manually by switch.



Strainers . . .

. . .to protect boiler feed, condensate and circulating pumps, other equipment in new piping for condensate steam, oil, water, process lines—*Leslie Co., Dept. HPAC, 105 Delafield Ave., Lyndhurst, N. J.*

Startup strainers available in 6 to 16 in. steel construction with 150 or 300 lb flanges. "Straight through" construction keeps pressure across strainer to minimum, says company. Removable screen permits option of leaving strainer body in line permanently or removing entire strainer for re-use, replacing with spool piece. Strainer can be cleaned by inserting air, steam, water lance, flushing trapped debris down cleanout drain. Cleanout drain threaded for cap or gate valve; strainer may be installed horizontally or vertically. Upstream, downstream bosses provided for pressure drop measurement.

pH Control . . .

. . .designed to prevent buildup of slime, algae, corrosion, scale in air conditioning, humidifying, heat exchange equipment—*Oakite Products, Inc., Dept. HPAC, 19 Rector St., New York.*

"Airefiner No. 51" used at concentrations 2 to 4 lb per 1000 gal of water, controls scale, keeps pH of water in low alkaline range, minimizes dilignification of wooden cooling towers, etc., says manufacturer Nontoxic, unaffected by heat, soluble in hot or cold water. May be circulated through equipment in meat packing, dairy, food plants.

Gasket Material . . .

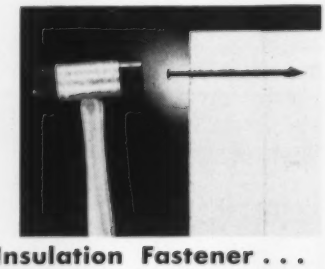
. . .designed for more efficient sealing of fluorinated hydrocarbon refrigerants—*Armstrong Cork Co., Dept. HPAC, Lancaster, Pa.*

"Accopac AN-890" made by beater-saturated process which refines asbestos materials used in applications. Method eliminates lumps, bunches to form flexible homogeneous sheet. Die cuts cleanly to complex shapes, says manufacturer. Binder is nitrile type rubber latex which reacts to certain fluorinated hydrocarbon atmospheres by swelling. In confined flange, swelling improves sealing efficiency of material. Available in rolls, sheets, ribbons, die-cut pieces.

Leak Detectors . . .

. . .of halogen type in new line adaptable to wide range of industrial applications—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

Line comprised of type "H-2," "H-3," "H-3," "H-4," "H-5"; each has four detector heads for use with one standard control unit. Models can locate leaks as small as 10^{-6} cc per sec. Locates leaks in closed system or component under pressure or vacuum using any halogen compound tracer gas. Gas can be introduced as tracer into system that does not already contain a halogen gas. All models designed for 120-240 volt, 50-60 cycle operation.

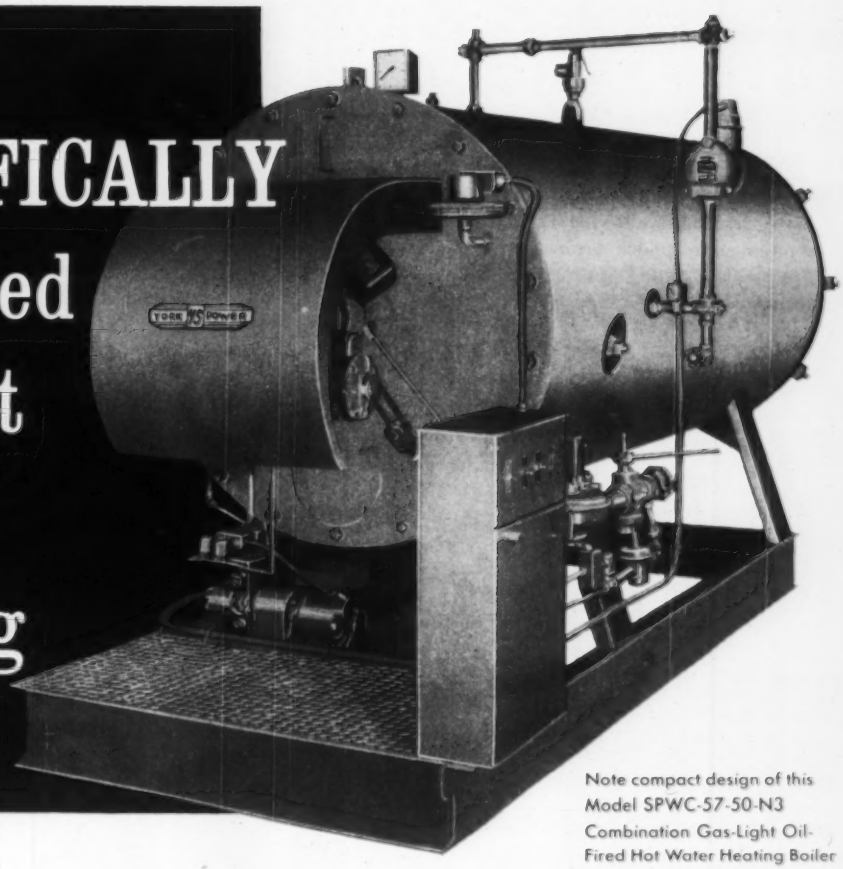


Insulation Fastener . . .

. . .of polysterene plastic construction—*Armstrong Cork Co., West Liberty St. Dept. HPAC, Lancaster, Pa.*

New tip and oversize head of skewer provides great holding power, says manufacturer. Tip is pointed at angle calculated to increase holding power when driven flush into insulation board; oversize head provides bearing surface that pulls, holds layer of insulation. Plastic skewers

SPECIFICALLY Designed For Hot Water Heating



Note compact design of this Model SPWC-57-50-N3 Combination Gas-Light Oil-Fired Hot Water Heating Boiler

York-Power Packaged Boiler Overcomes Operational Problems for All Types of Hot Water Heating Installations

The use of steam boilers for hot water heating, although accepted, has been inefficient and especially costly from a maintenance point of view because of internal shock and condensation. Now, York-Power engineers have achieved another first—the development of a completely packaged boiler designed *specifically* for hot water heating.

These advanced new units may be used for continuous heat delivery at varying rates of heat flow or for intermittent heat delivery at fixed rates of flow. To serve these two basic systems, York-Power engineers had to face up to and solve new problems not heretofore fully realized.

Here are the solutions:

1. *Elimination of Shock and Condensation* through proper use of mixing valves and an anti-shock control.

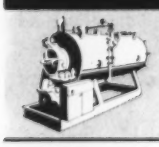
2. *Improved Water Circulation and Air Elimination* by reverse water flow through boiler supply water diffuser tube, and proper air venting.

3. *Lower Installation Costs* with factory-mounted and wired circulator and low-water cut-off and use of all-welded and flanged piping.

In addition, these new boilers mean worthwhile fuel economies because of their unitary design. They operate on gas as well as low-cost heavy fuel oils or lighter fuel oil. Models for combination gas/oil firing are also available.

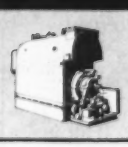
Now available in 14 sizes ranging from 26 H. P. to 500 H. P. Shipped complete—and factory tested. S. B. I. rated. Use these York-Power boilers on your next heating job. Mail the coupon for complete specifications TODAY!

Industrial Division **YORK-SHIPLEY, Inc.** YORK, PA.



STEAM-PAK
15 to 600 Hp.
Oil and/or Gas Firing

PAKETTE
10 to 50 Hp.
Oil and/or Gas Firing



FIRE-PAK
35 to 485 Hp.
Oil and/or Gas Firing

SCOT-PAK
52 to 400 Hp.
Oil and/or Gas Firing

Industrial Division—York-Shipley, Inc., York, Pa.
Please send me new illustrated brochure giving full details about York-Power's new line of Hot-water Boilers.

NAME _____

COMPANY _____

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CITY _____ ZONE _____ STATE _____

EQUIPMENT DEVELOPMENTS

Continued

will not rot, deteriorate in service, remain odorless, says manufacturer. Can be driven into place with lightweight hammer. Available in 3½, 4½, 5½ in. length, allowing 1½ in. penetration into under layer when used applying 2, 3, 4 in. thick insulation materials.

Industrial Thermometer . .

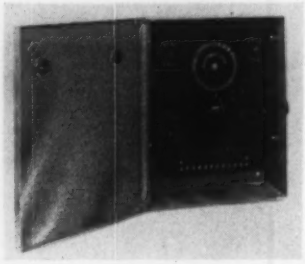
. . .designed for heating, ventilating, piping, air conditioning installations —*H. O. Trerice Co., Dept. HPAC, 1420 W. Lafayette, Detroit* 16.

New 9 in. "BX" industrial thermometer has case of cast aluminum construction, stainless steel front, white scale with black numbers with red appearing mercury tube. Available in nine standard temperature ranges from —40 to 1000 F. Five optional straight or angle mounting forms available for pipe lines (with or without insulation), air ducts.

Globe Valves . . .

. . .developed for hot or cold service with steam, raw water, gas, air—*Sinclair-Collins Valve Co., Dept. HPAC, 454 Morgan Ave., Akron* 11.

Diaphragm operated direct acting globe valves available in two series for 150, 300 psi service in sizes ¼ to 3 in. NPT. Valve bodies of Navy M bronze, all cast trim is special alloy bronze, top-guided stem and disc are k-monel, replaceable seat ring is hardened, ground stainless steel. Seats lapped at assembly, all parts interchangeable. Plastic-asbestos packers intended to prevent leaks at stem. Diaphragm tops designed for air operation at 30-35 psi.



Time-Temperature Control

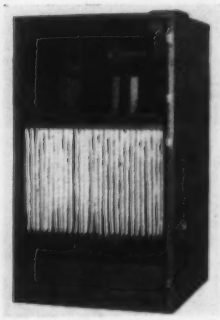
. . .in design combining inside program time switch with outdoor weather head—*Tork Time Controls, Inc., Dept. HPAC, 33 Grove St., Mt. Vernon, N. Y.*

Heat is cycled on inside control panel according to outdoor temperature, indoor requirements. Weather control starts, stops heating plant at preselected intervals as programmed on 24 hr dial. Setting of cycle tabs and limit control intended for rapid morning pickup and heat throughout system until shutdown. Once set, controls need no further adjustment. Panel signal lights indicate proper, current operation to attendants. For summer use system provides hot water without building heating. Optional equipment includes omitting device for automatically skipping operation on days when building may be closed. Unit is for line voltage only, vailable in 115 volt, 60 cycle and 208-230 volt, 60 cycle models.

Sheet Metal Elbows . . .

. . .with no transverse seams—*Consolidated Ventilating & Duct Co., Inc., Dept. HPAC, 19-10 Hazen St., Jackson Heights 70, N. Y.*

Heavy gage elbows are stamped in two halves, spot, arc welded together. Designed for high pressure air conditioning systems, suitable for dust collecting systems, any industrial application where round ducts or spiral wound pipe is used. Elbows available in sizes 3 through 12 in. diam. variety of gages.



Dust Collector . . .

. . .with new modification intended to improve filtering efficiency, reduce maintenance of unit—*Torit Mfg. Co., Dept. HPAC, 287 Walnut St., St. Paul, Minn.*

New model, "75-80," gives 4 to 1 ratio in moving air to filter area with 150 sq ft of cloth filters to maximum 600 cfm of air to be cleaned. Filters are of fine-woven cotton, specially treated to resist sparks. Dust storage drawer has 2 cu ft capacity. Unit measures 28 × 28 × 49 in. Equipped with 1 hp motor to move 600 cfm of air through 4 in. inlet at 4.0 in. water gage; 400 cfm through one 3 in. inlet at 5.0 in. WG; or 350 cfm through each of two 3 in. inlets at 4.0 in. WG.

Chemical Feeder . . .

. . .designed for use in the air conditioning industry—*Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia.*

Gravity chemical feeder designed to automatically feed chemical treatment to recirculating cooling water of evaporative condensers, air washers, cooling towers. Feeding unit connected electrically with water recirculating pump; by timing, mechanism allows measured increment of chemical feed solution to flow at 15 minute intervals of pump operation. Since evaporation in open cooling water system is approximately proportional to amount of water circulated, feeder will maintain relatively constant concentration of chemical treatment in cooling water, provided blowdown is proportional to amount of water circulated. Proportional blowdown provided by bleeding water from discharge side of recirculating water pump through valve.

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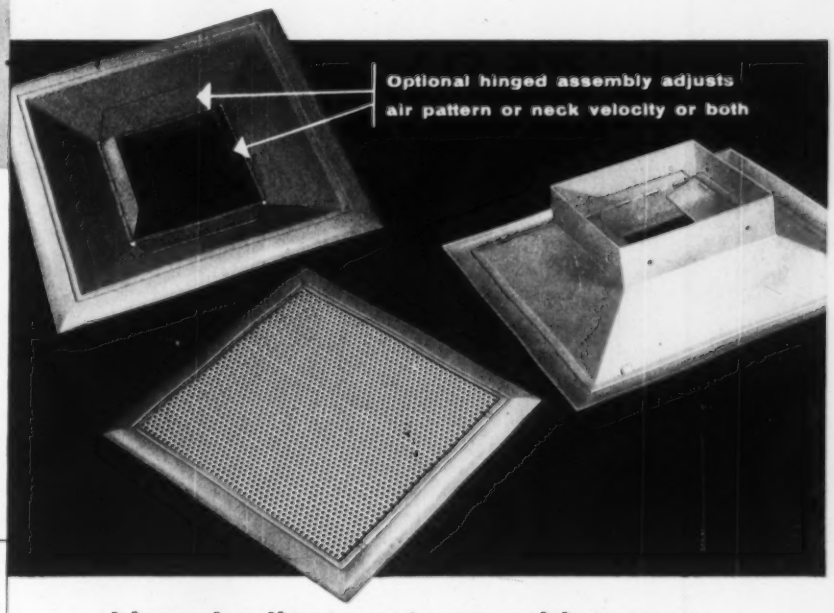
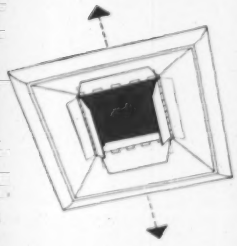
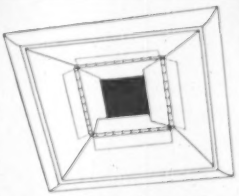
ENGINEERED AIR DISTRIBUTION

COMPLETE FLEXIBILITY OF ADJUSTMENT ON THE JOB WITH UNI-FLO CEILING DIFFUSERS

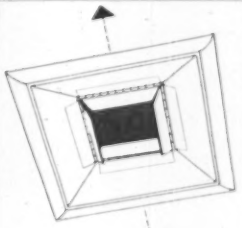




ADJUST AIR PATTERN
(2-way opposite pattern illustrated)



ADJUST NECK VELOCITY
(Adjustment for maximum velocity illustrated)



ADJUST AIR PATTERN AND NECK VELOCITY
(Adjustment for maximum velocity with 2-way opposite air pattern illustrated)

. . . hinged adjustment assembly saves time and trouble; provides correct air distribution to meet any conditions

The hinged adjustment assembly available optionally on Uni-Flo Square and Rectangular diffusers provides complete flexibility on the job to meet air distribution requirements of variable air patterns and throw. The units can be readjusted easily at any time to meet interior alterations. The attractive exterior of Uni-Flo diffusers is not altered.

Adjustment of the blades to the horizontal position provides maximum neck velocity and throw. Adjustment of one or more of the blades downward provides 1-way, 2-way, or 3-way air patterns. Correct positioning of the blades will control both air pattern and neck velocity.

For complete information and prices, call your nearby Barber-Colman Uni-Flo representative, or write today.

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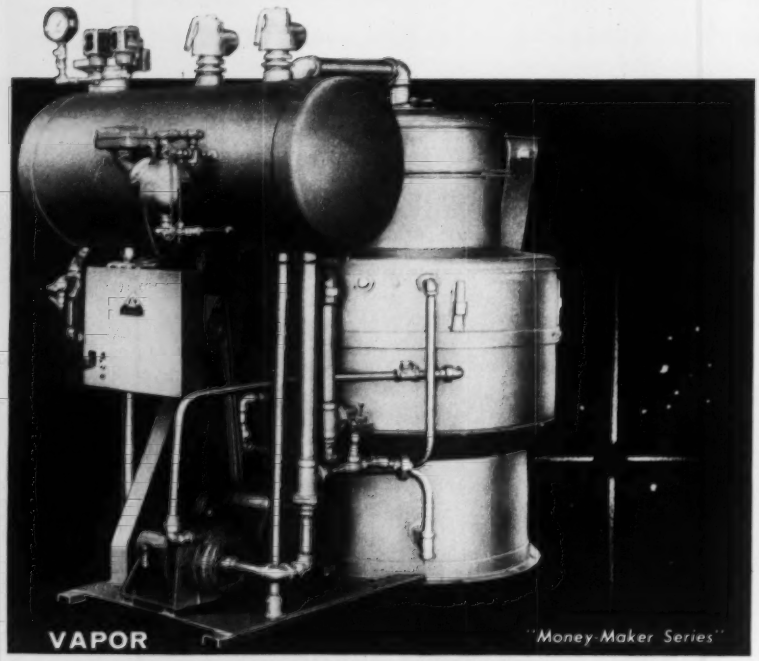

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are SO COMPACT . . . SO EFFICIENT . . . they require only one-fourth the floor space of conventional boilers of comparable ratings!

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And, Modulatic boilers *never require replacement.* Design permits easy, simple replacement of water-tube coils (or other parts), for lifetime peak efficiency.

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EQUIPMENT DEVELOPMENTS

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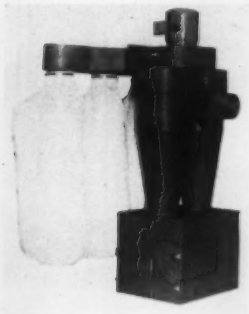


Dust Collectors . . .

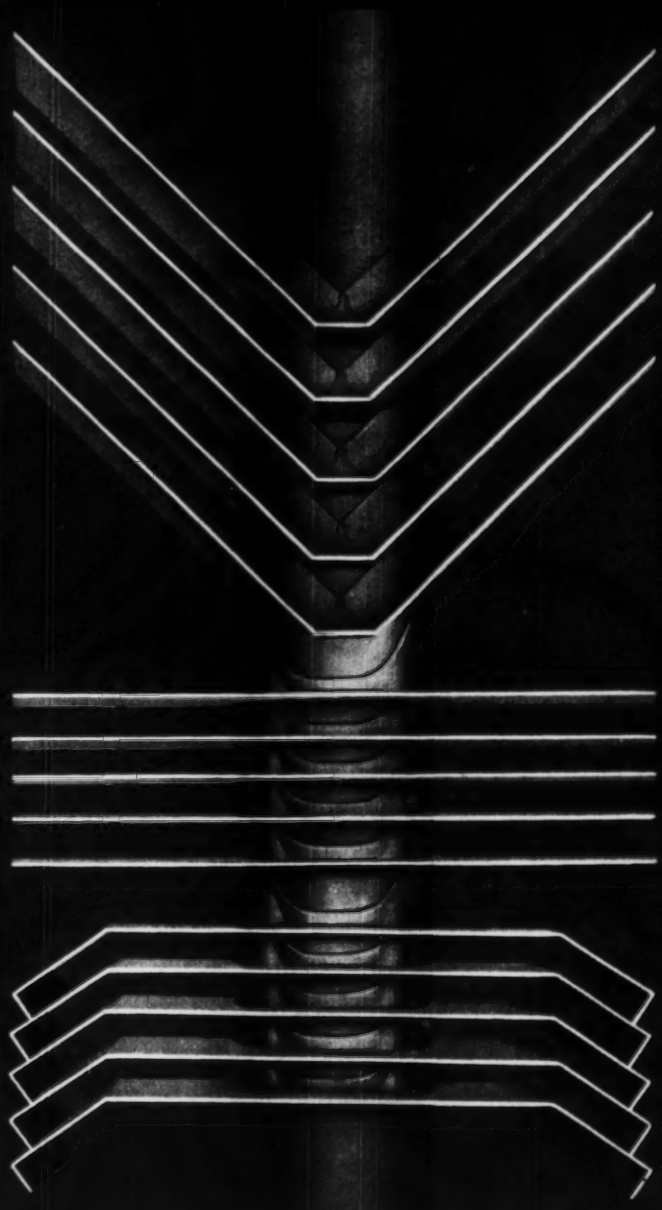
. . . in design change converting separator type dust collectors to radial fans—*Torit Mfg. Co., Dept. HPAC, 287 Walnut St., St. Paul, Minn.*

Radial fans said to move greater cfm of air, operate more efficiently against static pressure; new fans also said to eliminate buildup of foreign material on blades. No increase in hp requirements. Recommended for use where volumes of dust or lint and buffing compounds are to be collected. Air is drawn into collector where spiral baffles direct it into whirlwind motion. Dust particles precipitated out of air stream by centrifugal force, settle into dust reservoir below.

Solenoid Valve . . .

. . . with ⅛ in. orifice designed to operate in ranges up to 160 *psi—Airmatic Valve, Inc., Dept. HPAC,* 7317 *Associate Ave., Cleveland* 9.

There are no restrictions on orifice size of valve, with ⅛ in. port through all passages (12.5 cfm at psi). Valve is constructed with one piece internal moving part, with o-ring seals. Internal media does not pass around solenoid plunger, says company. Coil is sealed from air, oil, gas and water. Same coil is used for continuous or intermittent duty, a-c, or d-c. Valve can be either bottom drilled for manifolding or tapped for standard connection (⅛ or ¼ NPT).



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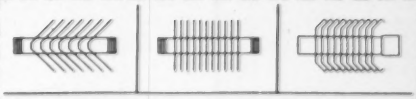
*PATENT NO. 2620171 AND OTHER PATENTS PENDING.



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WITH LAMINATED STAINLESS STEEL BELLOWS, 2 PLY OR MORE

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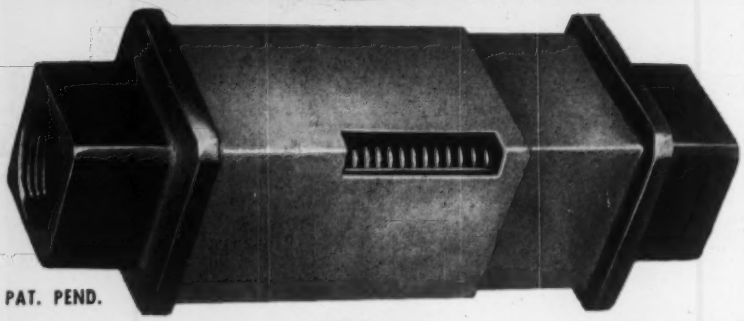

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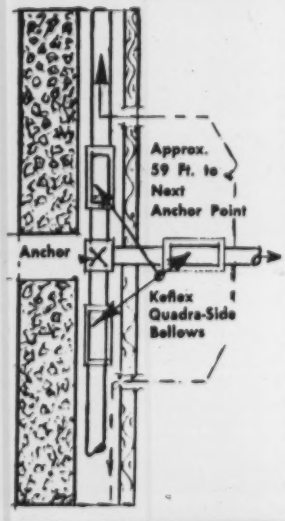
Working Pressure 300 P.S.I. — Temperature to 800°F. — Has Reserve Strength — Not Just Borderline Prospect of Withstanding Effect of Pressure — Shock — Thermal Line Expansion — High Temperature — Moderate Vibration. HIDDEN PROTECTION PLUS! All Non Corrosive Stainless Steel Bellows With Brass or Bronze End Fittings and Telescopic Shrouds.

KEFLEX FITS IN NARROWEST WALL SPACE—SAFE—PERMANENT



● **ROUND** KEFLEX Bellows are made of Laminated Stainless Steel, multiple ply (usually 2 ply or more) for greater strength with minimum force required to move bellows. The minimum force to move 7 Q Keflex Bellows greatly reduces the need for additional anchoring above that required to handle line pressure thrust force as the force to move Keflex 7 Q only is always less than 100 lbs.

● **FLAT** KEFLEX FLAT GUIDES offer so many advantages it is difficult to mention them all. Briefly: The KEFLEX FLAT OUTSIDE GUIDE (shroud) is made of brass USUALLY formed square of required length —one unit end will telescope over other unit end. The flat surfaces slide over and in one another—practically eliminating possibility of torque as result of faulty installation. This ASSISTS PROPER GUIDING.

● **SQUARE** KEFLEX SQUARE END FITTINGS are made of heavy, non-porous, square, bronze stock, and threaded tapered female pipe size. They are attached to the KEFLEX 7 Q bellows and the outside guides by silver brazing. The result is an easy moving expansion joint that will absorb either the slightest or the greatest thermal pipe expansion and with practically no load on the anchors. The heavy bronze ends, which will not crush during normal installations, assures safe and leakproof joints.

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SINCE 1905

KEFLEX MANUFACTURING DIVISION

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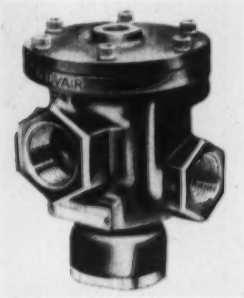
SAN FRANCISCO 5 63 MAIN ST. | PORTLAND 9, OREGON 328 N.W. BROADWAY | SEATTLE 4, WASHINGTON 2422—6th AVE. S.

EQUIPMENT DEVELOPMENTS

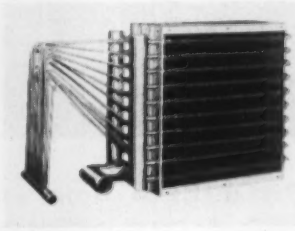
Continued



Poppet Control Valves . . .

. . . designed for remote pilot operation on large clutches, similar devices—*Valvair Corp., Dept. HPAC, 454 Morgan Ave., Akron* 11, *Ohio.*

Two and three way valves said to provide rapid response due to short poppet travel. Additional advantages: accurate cuts on high speed cutoffs, decreased clutch slip, faster machine setup, improved operating safety due to minimum machine drift and overtravel. Units have only three moving parts with stainless steel moving parts, Navy M bronze bodies, hycar sealing materials. "Hi-Speed Inline" valves available for remote pilot or integral pilot operation; normal working pressures 20 to 250 psi for remote operation; sizes ⅜ through 1½ in. NPT. Solenoid pilot coils for a-c, d-c, any voltage can be furnished.



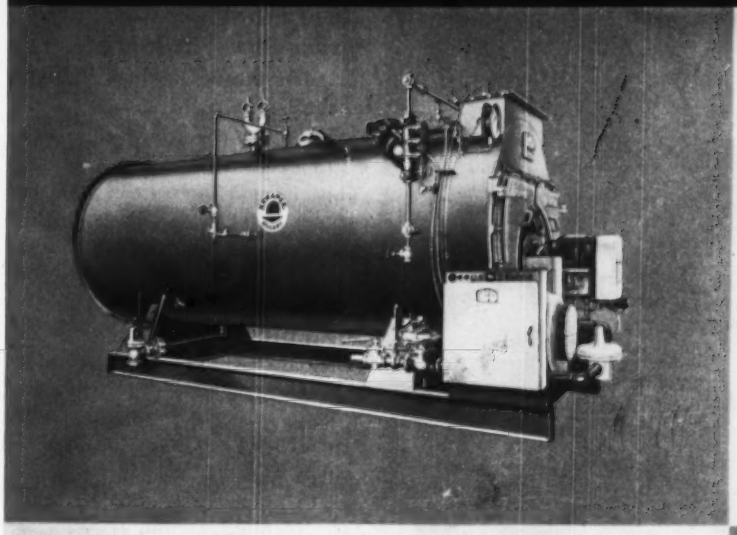
Steel Fin Coils . . .

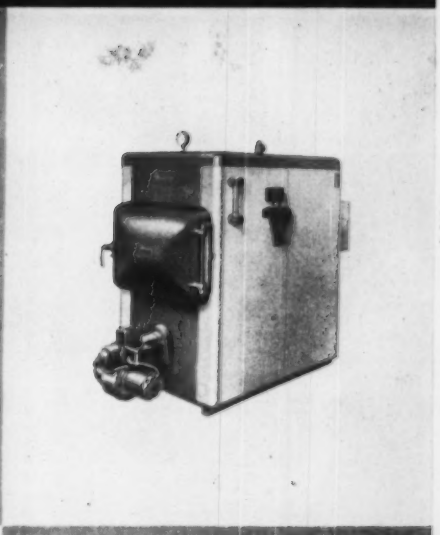
. . . designed for variety of applications—*Rempe Co., Dept. HPAC, 340 N. Sacramento Blvd., Chicago* 12.

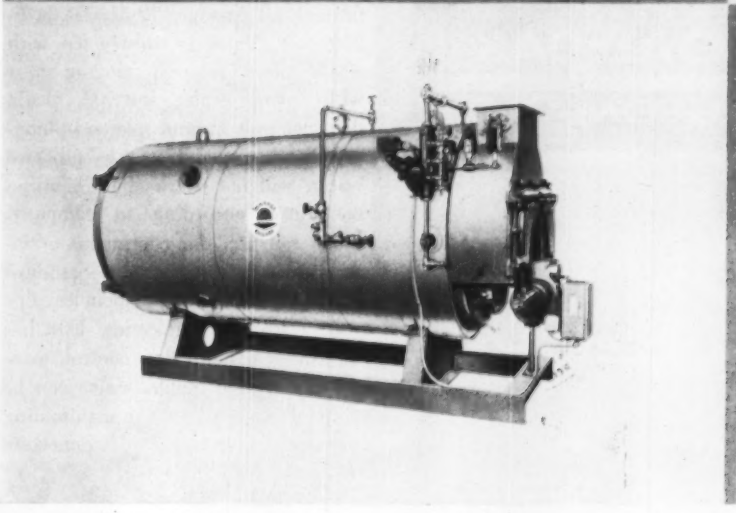
Steel fin coils have been used for high temperature testing in missile, aircraft, other fields. They will withstand temperatures to 1000 F. Coils also used in environmental chamber service, with wide range of temperature adaptability: from −75 to 1000 F. When local codes permit use of

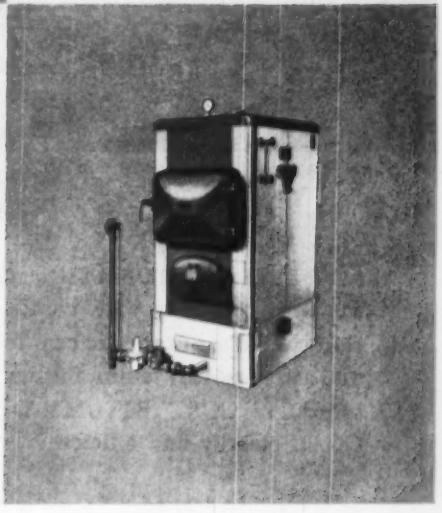
KEWANEE® PACKAGES

36 sizes span a full range of fuels









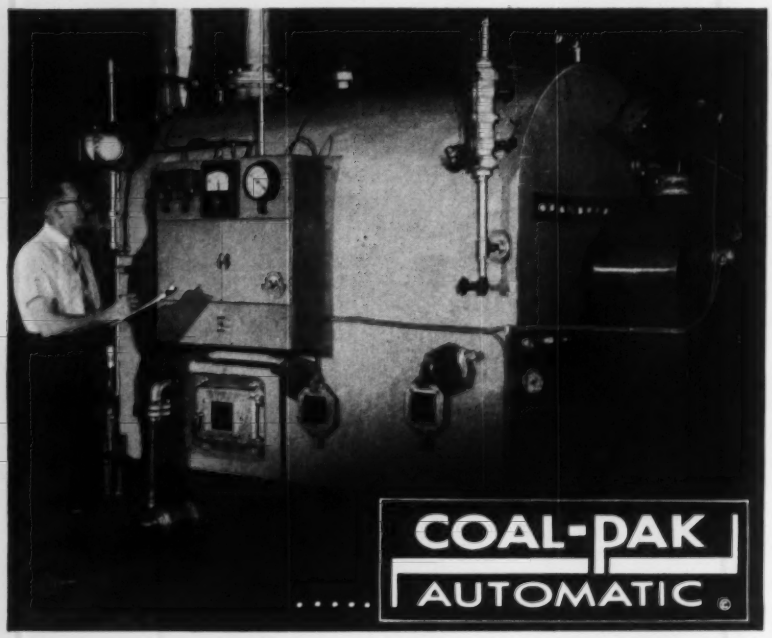
Now Kewanee's family of integrated boiler-burner packages covers a spread of sizes from 18 to 651 hp in high pressure models . . . 216,000 to 21,855,000 Btuh, low pressure. The fuel range is all-inclusive, too—oil from No. 1 through No. 6 . . . natural, manufactured, mixed or LP gas . . . oil-gas combination firing on any Scotch type package . . . forced draft eliminates high stacks. Factory assembling and fire-testing on Scotch type packages, when desired, means only five simple connections for installation. For complete facts on any type, any size or any fuel, contact your nearby Kewanee Man. AMERICAN-STANDARD, KEWANEE BOILER DIVISION, 115 Franklin Street, Kewanee, Illinois.

AMERICAN-Standard

KEWANEE BOILER DIVISION

STOP and SEE

the INTERNATIONAL-BCR



First FULLY AUTOMATIC package unit complete with combustion controls, automatic coal feed and ash removal system, for burning LOW COST BITUMINOUS COAL cleanly and efficiently.

Get the facts from your INTERNATIONAL DISTRICT REPRESENTATIVE or write for Bulletin 1100

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EQUIPMENT DEVELOPMENTS

Continued

ammonia in cooling systems, steel coils used with ammonia available in sizes 2 to 50 tons with multi-outlet expansion valve.

Plastic Pipe Fittings . . .

. . . of synthetic fabric insert type for flexible polyethylene pipe — *Industrial Plastic Fittings Co.*, 3891 *W.* 150*th St.*, *Cleveland* 11.

Fittings resist pressure of 1600 psi, company says, also withstand temperatures exceeding 250 F.

Solenoid Valve . . .

. . . with 1/8, 3/16 in. orifices that allow operation to about 200 psi— *Airmatic Valve, Inc., Dept. HPAC*, 7317 *Associate Ave., Cleveland* 9.

Valve has no restrictions on orifice sizes, with 1/8 in., 3/16 in. ports through all passages (2-35 cfm at 0-200 psi). Valve is constructed with single piece internal moving part with o-ring seals; internal media does not pass around solenoid plunger. Coil is sealed from air, oil, gas, water, will not overheat on continuous duty, according to company. Same coil used for continuous or intermittent duty, a-c or d-c. Standard price and construction includes pipe exhaust conduit connection. Unit has adjustable exhaust flow control, manual override available. Valve can be either bottom drilled for manifolding or tapped for standard connection (1/8 or 1/4 NPT).

Industrial Thermometer . . .

. . . redesigned for greater legibility —*Weksler Instruments Corp., Dept. HPAC, E. Merrick Rd., Freeport, N. Y.*

Case of submarine type "Series

ECON-GREEN-ROLL*

A DISTINCTIVE AUTOMATIC AIR FILTER THAT MERITS **YOUR** SELECTION

The Econ-O-Roll Air Filter is today's modernized version of the Green 'Sure Seal' Filter placed on the market a few years ago. The original sound basic design has been retained. The improvements are in several of the details which are described fully in Bulletin No. 176.

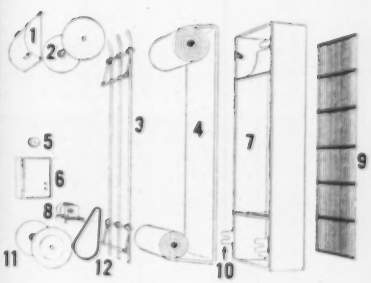
The ruggedly built Econ-O-Roll Air Filter has much to offer . . . with many operating and low maintenance values. You should give it full consideration in connection with that air filtering problem you have. When writing for literature, let us have the details of your problem.

You can have confidence in the Green Line, which for many years has included Mechanical Draft Fans, Economizers and Dust Control Equipment.

* U.S. Patents Pending

Outstanding Features Include

- *free-floating, self-adjusting seal assembly*
- *superior filtering media*
- *choice of automatic control*
- *wide capacity range*
- *simple and easy roll change*
- *few moving parts*
- *automatic 'end-of-roll' shut-off with warning light*
- *no jobsite wiring*



1. Media Cover
2. Media Supply Shaft
3. Seal Assembly
4. Roll of Media
5. Draft Gage
6. Control Panel
7. Filter Housing
8. Drive Assembly
9. Media Retaining Grill
10. Shaft Bracket
11. Media Take-up Shaft
12. Chain

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POWER AND PROCESS PLANT EQUIPMENT

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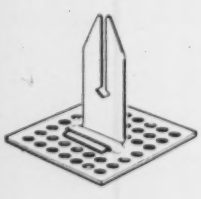
Stic-Klip®...

is the answer to

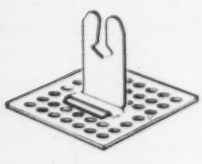
ANCHORS AND FASTENERS

for every type of

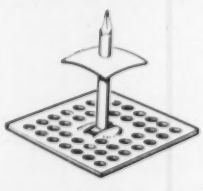
INSULATION



TYPE A KLIP for applying low-density mineral board insulation.



TYPE B KLIP for applying medium density mineral board insulation.



TYPE N KLIP with Speed Washer for dense and puncture-resistant insulations.

Fast Economical Application...

. . . is the secret of Stic-Klip's success. Designed for attaching insulation quickly and lastingly to nearly all curved or flat metal, wood or masonry surfaces.

Surface punching or drilling is unnecessary. There's no fire hazard, no expensive tools to buy and they can be quickly and easily applied by unskilled labor. There's a Stic-Klip for nearly all your insulation fastening requirements.

Send for your Free illustrated folder showing how you can save money on your next installation.

Ask about the time and labor saving 5-Second Application method.

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MANUFACTURING COMPANY, INC.

78 REGENT STREET, CAMBRIDGE 40, MASSACHUSETTS

EQUIPMENT DEVELOPMENTS

Continued

140" thermometer is one piece brass forging, now measures 5¾ in. high by 1⅜ in. wide. Recommended by manufacturer for industrial applications where space is important factor. Available in standard gages with brass or monel sockets in five rigid angles or with company's "Adjust-Angle."

Solenoid Valves . . .

. . . available in two and three way, normally open and closed types, with range zero to 400 psi—*Allied Control Co., Inc., Valve Div., Dept. HPAC, 2 East End Ave., New York, N. Y.*

Design features cited by company include magnetic structure permitting greater flow of fluid, high pressure ratings; soft, synthetic plunger insert, welded joints to prevent leakage; installation in any position due to spring loaded plunger design. Coils available for practically any voltage requirement, says manufacturer. Valves have packless construction, only two moving parts.

Motorized Gear Unit . . .

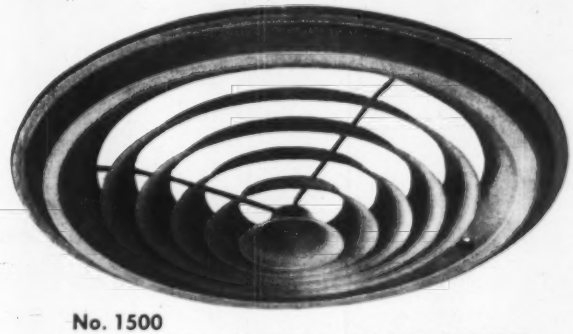
. . . designed for installations where downtime is critical—*Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

"Line-A-Spede" are gear reducers powered by standard NEMA frame motors mounted on shelf attached to reducer. Double, triple, quadruple reduction gear units, ratios to 1487 to 1, available for motor ratings 1 to 75 hp. Motors can be replaced by disconnecting coupling between motor

Now Offers Its LATEST ACHIEVEMENT

No.1500 STEP-DOWN
No.1501 FLUSH-TYPE

ROUND CEILING DIFFUSERS



No. 1500
U.S. ROUND STEP-DOWN CEILING DIFFUSER

CROSS-SECTION No. 1500 STEP-DOWN DIFFUSER

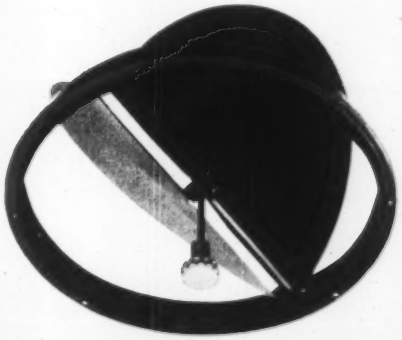
CROSS-SECTION No. 1501 FLUSH-TYPE DIFFUSER

VALUES YOU CANNOT EQUAL

The NEW No. 1500 Round Ceiling DIFFUSER with WIDE, DEEP ANTI-SMUDGE RING Protects CEILINGS and PERFECT GASKETS PREVENT STREAKAGE.

The No. 1500 STEP-DOWN-TYPE May be equipped with No. 1800 Dampers. The No. 1500 CEILING DIFFUSER has a Free Area in Excess of Other Makes.

The No. 1501 Round Flush-Type DIFFUSER May be equipped with No. 1801 Dampers and with Frames only as can also the No. 1500 Step-Down Ceiling Diffuser. Nos. 1500 STEP-DOWN and 1501 FLUSH-TYPE CEILING DIFFUSERS are Individually Packed and Shipped 10 Per carton.



No. 1800 or 1801 ROUND CEILING DAMPER

Nos. 1800 and 1801 ROUND CEILING DAMPERS

are made for Screw-Driver Unmolestable Bi-Valve Setting. No. 1800 and 1801 ROUND CEILING DAMPERS are furnished with "SNAP-ON" Knob Operators for Hand Operation of GEARED BI-VALVES.

This Knob-Operation is very convenient in Living and Sleeping Rooms Where Volume Control is Required. It ELIMINATES those OBNOXIOUS BREAKABLE CHAINS.

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WRITE For Supply of Our LATEST ATTRACTIVE CEILING DIFFUSER FOLDERS COVERING The No. 1500 Round and No. 2500 Square Ceiling Diffusers, Dampers, and Frames. Now Ready.

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DURABLA REDUCING COUPLINGS NOW AVAILABLE FOR USE WITH *Basic-Check* UNITS

this combination is all you need to form a low cost, all stainless-steel check valve

Now, you can get DURABLA Reducing Couplings to match DURABLA ***Basic-Check*** Units. Supplied in line sizes from ⅜" to 2", they are recommended wherever a complete stainless steel (18-8) line check valve is required.

There has been no change in the ***Basic-Check*** Unit. It can still be used with almost *any standard pipe fitting* or, now, with a DURABLA Reducing Coupling. In either case, you have a complete check valve that will operate in any position — horizontally, vertically (with the inlet either up or down), and at any angle between. Suitable for almost any service — over a wide range of pressure-temperature ratings.

With a few of these units in stock you can meet practically any check valve emergency. For the full story, send for a copy of *new* 8-page bulletin HPAC 88.

DURABLA MANUFACTURING COMPANY
114 Liberty Street, New York 6, N. Y.

Basic-Check Unit
(Pat. No. 2,649,277)

Reducing Coupling

Complete Check Valve

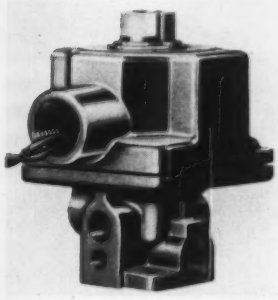
DURABLA

DM-31

EQUIPMENT DEVELOPMENTS

Continued

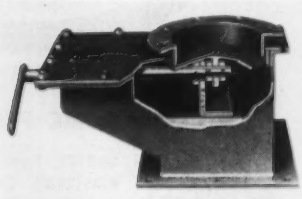
and reducer. In multi-unit gearmotor installations of similar rating, standby protection given by one standby motor of largest size required. Units available for horizontal, vertical, flange, incline, sidewall or ceiling mounting. Backstop to prevent reversed rotation is optional feature. Gear portion also available separately without motor or mounting shelf.



Solenoid Valves . . .

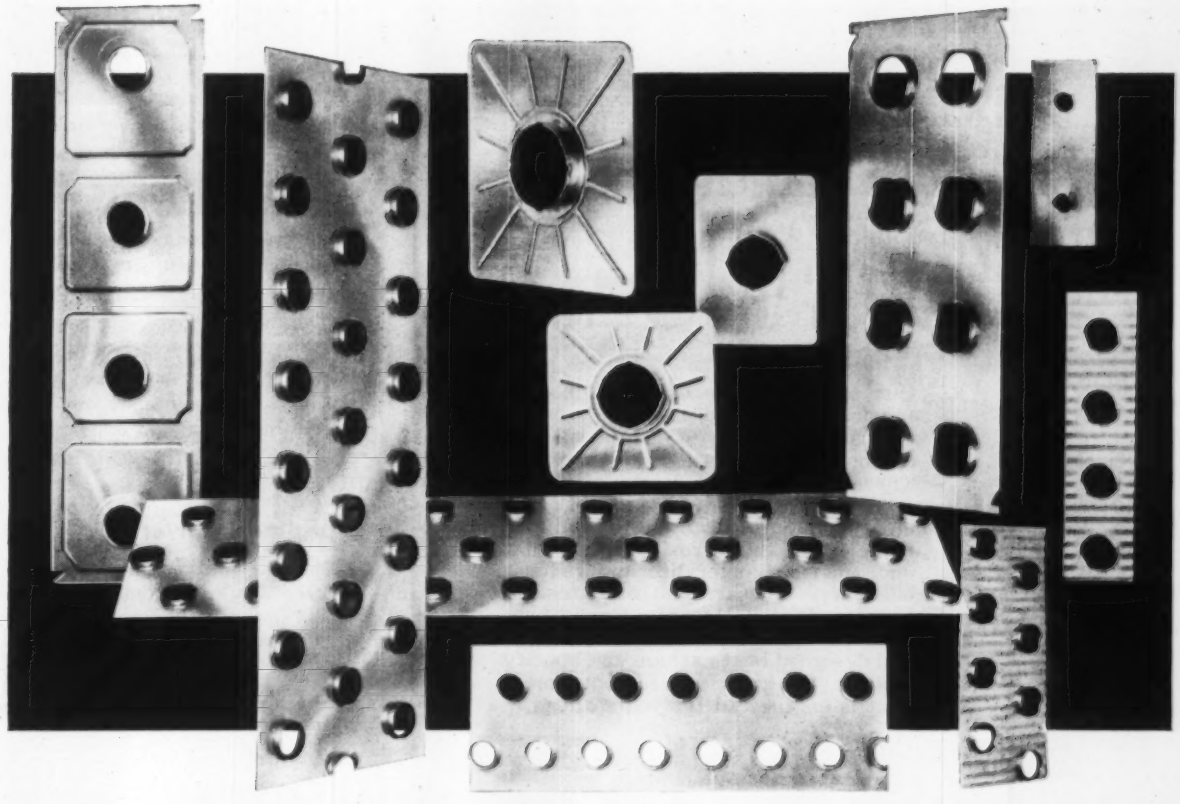
. . . intended for use with medium size cylinders—*Skinner Electric Valve Div., Dept. HPAC, 105 Edgewood Ave., New Britain, Conn.*

First of "A Series" line is three-way normally closed valve with 5/32 in. orifice and ¼ in. NPT ports, pressure rating of 125 psi. Intended for media such as oil air, inert gases. Valve weighs 3 lb; 3⅞ in. high, 2⅝ in. square. Body, mounting are noncorrosive zinc, internal parts stainless steel. Plunger is spring-loaded, direct-acting, valve can be mounted in any position by means of two ¼-20 mounting holes. Soft synthetic inserts used.



Shutoff Valve . . .

. . . for dry dust collector hoppers, storage bins, transport lines—*Ducon Co., Inc., Dept. HPAC, 147 E. Second St., Mineola, N.Y.*



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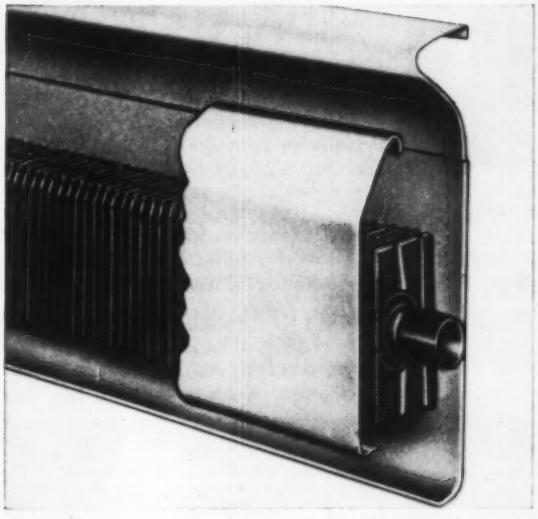

National-U.S. Radiator Corporation "Art Comfortline Baseboard" contains an advanced line heating element for a balanced combination of radiant and convected heat. Wrought aluminum fins 3003 alloy, .012" thick, are permanently bonded to copper tubes. Fairmont Aluminum sheet stock is selected for uniformity and excellence of performance.

To meet widely differing specifications in the manufacture of heat-transfer surfaces such factors as size, shape, thickness, perforation and spacing of fins are given proper evaluation by design engineers. Of equal importance is the aluminum fin's ability to withstand rapid mechanical forming in production and assembly without developing cracks or buckling, its ability in service to withstand temperature, moisture and mechanical attacks.

Along with rigid quality control, Fairmont offers "individualized" attention to manufacturers' requirements for coiled and flat sheet in 1100, 3003, 5005, 5050 and 5052 alloys. Let us show you why Fairmont aluminum is being specified by the foremost heat transfer product manufacturers. Write or call today.

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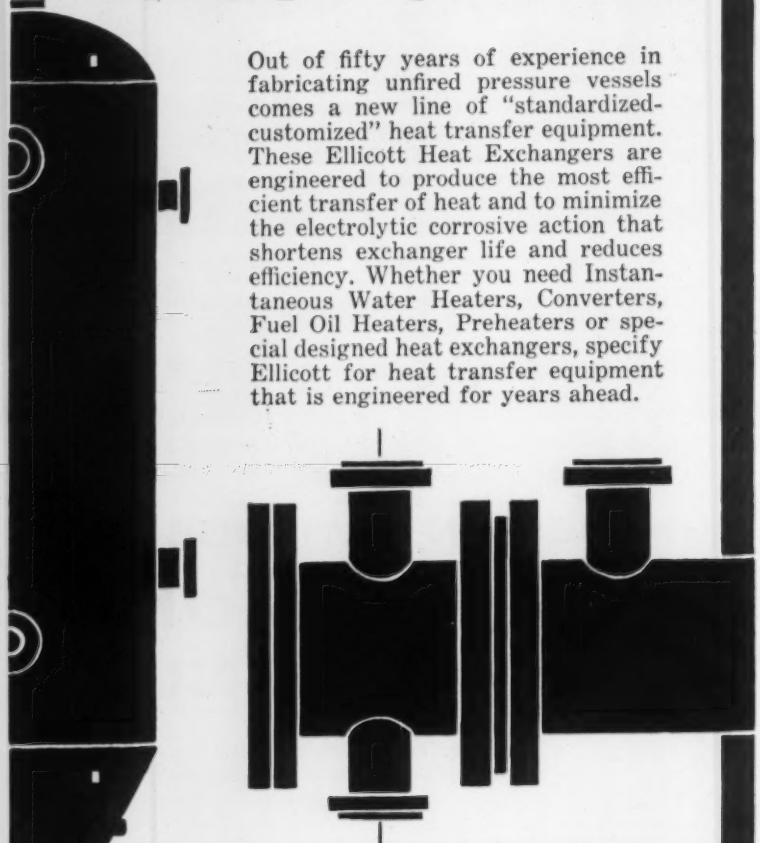
Engineered for years ahead

HEAT EXCHANGERS

Out of fifty years of experience in fabricating unfired pressure vessels comes a new line of "standardized-customized" heat transfer equipment. These Ellicott Heat Exchangers are engineered to produce the most efficient transfer of heat and to minimize the electrolytic corrosive action that shortens exchanger life and reduces efficiency. Whether you need Instantaneous Water Heaters, Converters, Fuel Oil Heaters, Preheaters or special designed heat exchangers, specify Ellicott for heat transfer equipment that is engineered for years ahead.



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THERE'S NO EQUAL

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EQUIPMENT DEVELOPMENTS

Continued

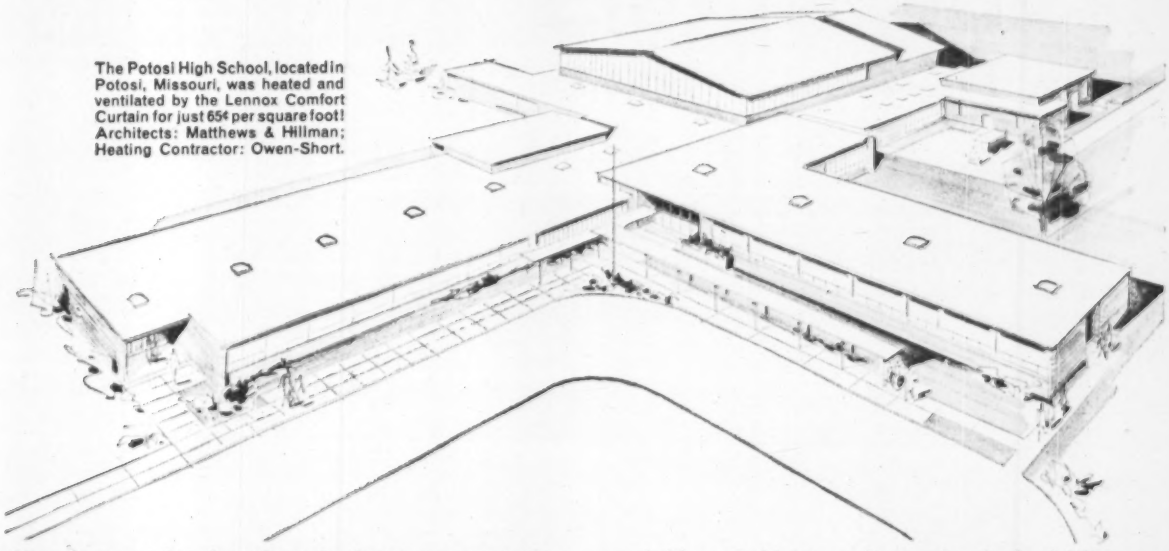
"Type SL" slide gate has following advantages, according to manufacturer: positive, gastight, dust-tight when closed; nonsticking, due to free sliding action with no close tolerances involved; one handle used for operation; when gate is open, no part of gate mechanism is in path of discharging material. Said to be suitable for all dry, free flowing products, including chemicals, grains, fertilizers, dry pigments, ore dusts, plastics, metal powders, others. Available with round or square inlet.

Equipment Briefs . . .

SOLENOID CYLINDERS designed to control heavy duty levers, dampers, etc., wherever mechanical motion is involved—*Automatic Switch Co., Dept. HPAC, Florham Park, N. J.* Cylinders are single acting, controlled by three way solenoid valve arranged to alternately supply or vent pressure. Changes in stroke, load do not affect current inrush, according to manufacturer. Available in two sizes: 3½ in. size—maximum load at 150 psi is 360 lb; 2¼ in. size—maximum load at 150 psi is 375 lb. Cylinders may also be used as valve actuators.

WELDING GROUND CLAMPS with company's ball-point type cable connection—*Tweco Products, Inc., Dept. HPAC, P.O. Box 666, Wichita 1, Kans.* New connection makes it possible for a welder to attach ground clamp to welding cable in less than two minutes, according to manufacturer. Cable socket 9/16 in. is drilled in clamp casting; at right angles to socket another 9/16 in. hole is drilled and tapped; cadmium plated ball-point goes in tapped hole. To install ground clamp, weldor strips 1 in. of cable socket, tightens ball-point screw down directly on cable strands. Large 7/32 in. hex drive wrench is used. Formed steel ring attached to clamp is tightened around cable jacket to support cable.

Potosi school gets the finest in fresh air heating and ventilating—installed complete with automatic controls—for just 65¢ per square foot!



The Potosi High School, located in Potosi, Missouri, was heated and ventilated by the Lennox Comfort Curtain for just 65¢ per square foot! Architects: Matthews & Hillman; Heating Contractor: Owen-Short.

New Lennox Comfort Curtain System automatically draws in fresh air from outside . . . warms, cleans and circulates air quietly and evenly throughout the classroom!

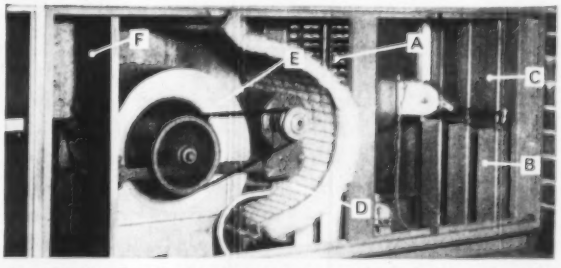
Hard to believe, isn't it?—that after all these years a new and better fresh air heating and ventilating system can be installed *for a fraction of the cost* of systems used previously. Yet it's true! 65¢ per square foot was the *complete* cost of the Lennox Comfort Curtain System in the Potosi, Missouri High School. Including fully automatic controls, ductwork, labor—everything!

Of course, 65¢ per square foot is unusually low, even for the Comfort Curtain. But costs of $1.03 in Indiana, $1.15 in Montana, and $1.12 in South Dakota are *usual and typical* of the amazing savings offered by the Lennox Comfort Curtain.

How is this possible? The Lennox Comfort Curtain System applies to schools the sound, tested principles of warm air heating. It eliminates expensive pipes, boilers and chimneys. Moreover, it saves hundreds of dollars per classroom per year *every* year it is in use. Fuel is consumed only when heat is required, maintenance is amazingly simple and low-cost. Yet—and this is important—the Lennox Comfort Curtain System does a far better job than costlier systems used previously.

It provides a full, even flow of air throughout the entire length of the exposed classroom wall. It is amazingly quiet. And it holds room temperatures to a variance of six-tenths of one degree, circulates air continuously for perfect distribution, introduces a continuous supply of fresh air into the daytime heating cycle, and provides *tons* of needed fresh air cooling without the cost of refrigeration!

Get full information on this new low-cost system of classroom heating and ventilating. Send coupon below for free booklet, today!



Lennox Air Processing Unit introduces fresh air in adjustable volumes (A); transmits warm air (B) from adjacent or remote heating unit; continuously recirculates indoor air (C); filters air clean (D). Lennox' exclusive floating blower (E) and acoustical lining (F) assure a degree of quietness never before achieved.

LENNOX

© 1958 Lennox Industries Inc., Heating and Air Conditioning, founded 1895; Des Moines and Marshalltown, Ia.; Syracuse, N. Y.; Columbus, O.; Decatur, Ga.; Ft. Worth; Los Angeles; Salt Lake City. In Canada: Toronto, Montreal, Calgary, Vancouver, Winnipeg.

Lennox Industries Inc., Dept. HP-85
1701 E. Euclid Ave., Des Moines 5, Iowa

Gentlemen: Please send me your free booklet on the Comfort Curtain system of classroom heating and ventilating.

NAME _____

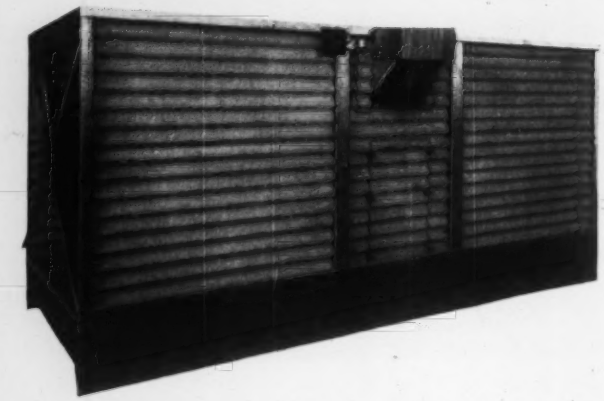
ADDRESS _____

CITY _____ ZONE ____ STATE _____

LITTLE DETAILS MAKE

BIG ADVANTAGES

IN Havens COOLING TOWERS



Here they are . . . Count 'em!

1. All parts double dipped galvanized with over 2-oz. of Zinc per square foot of surface.
2. Galvanizing is done after fabrication and before assembly. All surfaces, exposed or hidden, are heavily protected.
3. The select all-heart California Redwood fill in Havens Towers is supported by angles or channels welded to basin sidewalls, leaving basin free for easy cleaning. Distribution trays are furnished above fill trays to provide even distribution of water over filling.
4. Fan shafts on small models are stainless steel, ground to 10 micro inches. Larger model shafts are heavy zinc plated cold rolled steel.
5. Fan shaft bearings run in continual oil bath with provision for collection of water and impurities in a sump. Oversize bearings are used on all models.
6. Bearings can be externally lubricated. An oil cup, connected to bearing with transparent nylon tubing permits visual inspection. Capacity 3 ounces.
7. Available without steel basins and shipped assembled—for setting on concrete basin.
8. Models available in capacities from 3 to 600 tons.

Send for Literature

Havens

COOLING TOWERS

Division of

HAVENS STRUCTURAL STEEL COMPANY

1713 Crystal Avenue, Kansas City 26, Missouri

MEMBER OF ARI COOLING TOWER SECTION

EQUIPMENT DEVELOPMENTS

Continued

SLIDE RULE in circular design—*General Industrial Co., Dept. HPAC, 5738 Elston Ave., Chicago* 30. Slide rule developed to perform simple calculations. With this unit problems in multiplication, division, proportions can be solved. Instructions included with each slide rule.

HUMIDITY INDICATOR for office, school, factory applications—*Andrew Technical Supply Co., Dept. HPAC, 7068 N. Clark St., Chicago.* "Humigraph" is 2 × 6¾ in. card with seven indicator spots whose colors change from blue to pink as atmospheric humidity changes. It reads from 10 to 80 percent RH, works at any temperature from 40 to 200 F.

LIQUID FLUX developed for brazing silver, gold, platinum and for many electronics applications—*Eutectic Welding Alloys Corp., Dept. HPAC, 40-40 172nd St., Flushing 58, N. Y.* "Eutec-Liquitor" liquid flux can be applied with pipette, eye dropper, hypodermic needle, as well as automatic metering devices. Operator can observe heating and melting phases. Rings, washers, other preplaced alloys can first be dipped into flux.

MIST COLLECTORS to collect mist and fog from all wet machining operations—*Torit Mfg. Co., Dept. HPAC, Walnut and Exchange Sts., St. Paul, Minn.* Use no high voltage electronic equipment, filtering air by passage through spun glass filters. Filter panels designed to last for months under regular operating conditions, can be replaced by removing screws, lifting off side panel screens.

DRAFT GAGES with internal alarm or signal system—*Ellison Draft Gage Co., Dept. HPAC, 546 W. Monroe St., Chicago* 6. New line combines indicating draft gage with magnetic type mercury switch for operating alarm or signal light. Can be furnished with one or two switches for high or low electrical contacts for alarm purposes. Transformer, bell or light furnished for 110 or 220 volt.

Here's How KENNEDY'S Union Bonnet and Hex End Design Give You Easier Installation, Longer Valve Life...

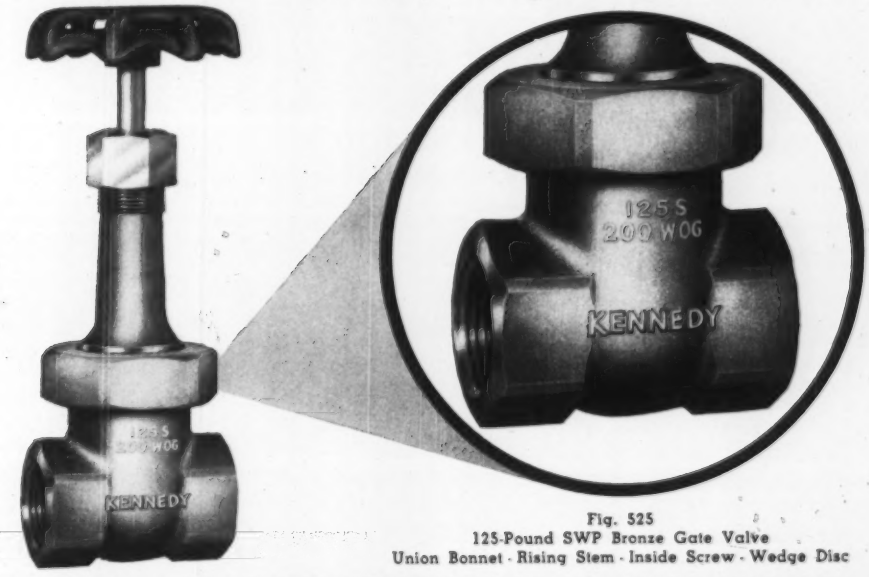
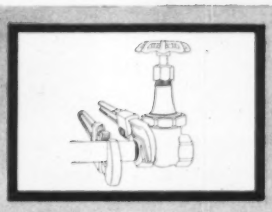
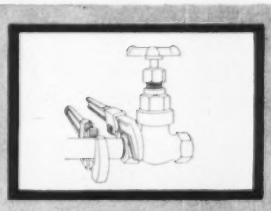


Fig. 525

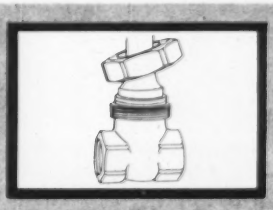
Fig. 525
125-Pound SWP Bronze Gate Valve
Union Bonnet · Rising Stem · Inside Screw · Wedge Disc



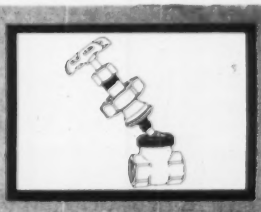
KENNEDY'S wider hex ends are blended into the body, making the body and hexes one rugged unit. Thus extreme wrench pressure is absorbed through the entire rigid valve body.



On conventional valve body, hex ends protrude from the body and are connected by thin body wrists. This area, under severe wrench pressure, can distort and cause disc seating trouble.



Kennedy's Union Bonnet permits repeated dismantling for cleaning or inspection and reassembly without danger of distortion to the valve. The bronze-to-bronze construction makes a tight union for tight, leak-proof operation.



Union Bonnet Fig. 525 can be easily disassembled into its component parts to installation in otherwise inaccessable places in existing lines or in new installations where space is limited.

These additional advantages make KENNEDY your best valve buy . . .

Heavy Bronze Union Bonnet Ring is entirely separate from the bonnet to eliminate any possibility of springing the bonnet face when assembling or disassembling the valve.

Cylindrical Body withstands sudden pressure. Kennedy's Cylindrical Body construction resists rupture and minimizes deflection when under severe pressure. Pressure in ordinary valve bodies tries to push the body wall out. Rupturing stresses concentrate where wall has the shortest radius. This deflection causes early failure in ordinary valves.

• *YOU CAN'T BUY A BETTER VALVE THAN A KENNEDY!*

KENNEDY VALVE MFG. CO.

1607 EAST WATER ST., ELMIRA, NEW YORK

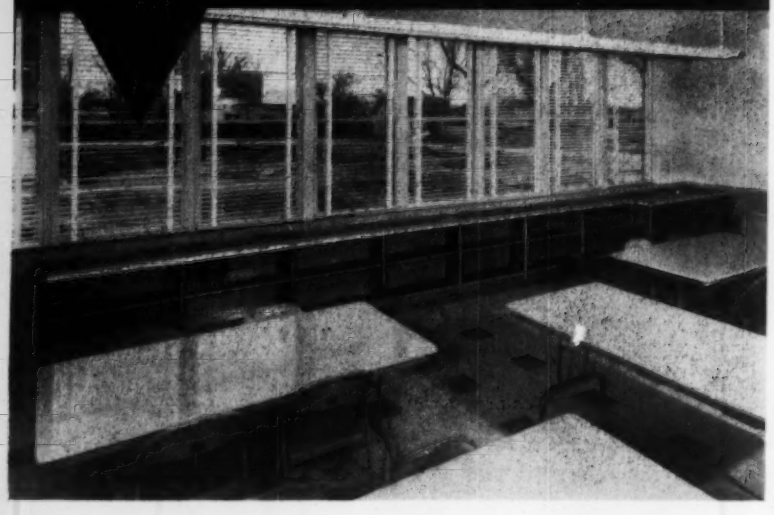
VALVES • PIPE FITTINGS • FIRE HYDRANTS

• OFFICES AND WAREHOUSES IN NEW YORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA • SALES REPRESENTATIVES IN PRINCIPAL CITIES •

Complete heating and ventilating

Classroom Comfort

PLUS TRIPLE ECONOMY



The **NORMAN** Complete Individual Schoolroom Package Provides Gas-Fired Heating...Fresh-Air Ventilation... plus Important Economies Right From the Start:

ECONOMY OF INSTALLATION . . . no expensive boiler rooms, chimneys, tunnels or costly revamping of central system. Pre-wired, partially-assembled Norman Systems are installed quickly, room by room—important economy in school expansion.

ECONOMY OF OPERATION . . . maintains uniform temperature without wasting fuel . . . supplies heat only when needed . . . ventilates automatically. Individual systems—no need to heat entire school for use of few rooms.

ECONOMY OF MAINTENANCE . . . Sturdy construction, finest materials and latest A.G.A. approved controls — standard to industry — assures long, trouble-free performance.

Versatile Norman Schoolroom Heating and Ventilating Systems fit any plan . . . Choice of 85,000 or 100,000 BTU/hr. inputs; Util-i-Duct Bookshelf (with or without sliding doors) or thin Wall-i-Duct comfort distribution sections.

HEAT AND VENTILATE YOUR SCHOOL WITH NORMAN SCHOOLROOM SYSTEMS . . . COMPLETE COMFORT PLUS TRIPLE ECONOMY

Photo Illustrates, Mingo School Addition, Tulsa, Okla.; Architect: Koberling and Brandborg A.I.A., Tulsa, Okla.; Mechanical Contractor: Palmer Plumbing and Heating Co., Tulsa, Okla.; Mechanical Sub-Contractor: Sand Springs Sheet Metal Co., Sand Springs, Okla.

Norman® products company

NORMAN PRODUCTS CO.
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We want to learn more about Norman Products for School Comfort. Please send complete information to:

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COMPANY NAME_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

See Sweet's Arch. File 30h/No, American Sch. and Univ. Annual C-1/No

EQUIPMENT DEVELOPMENTS

Continued

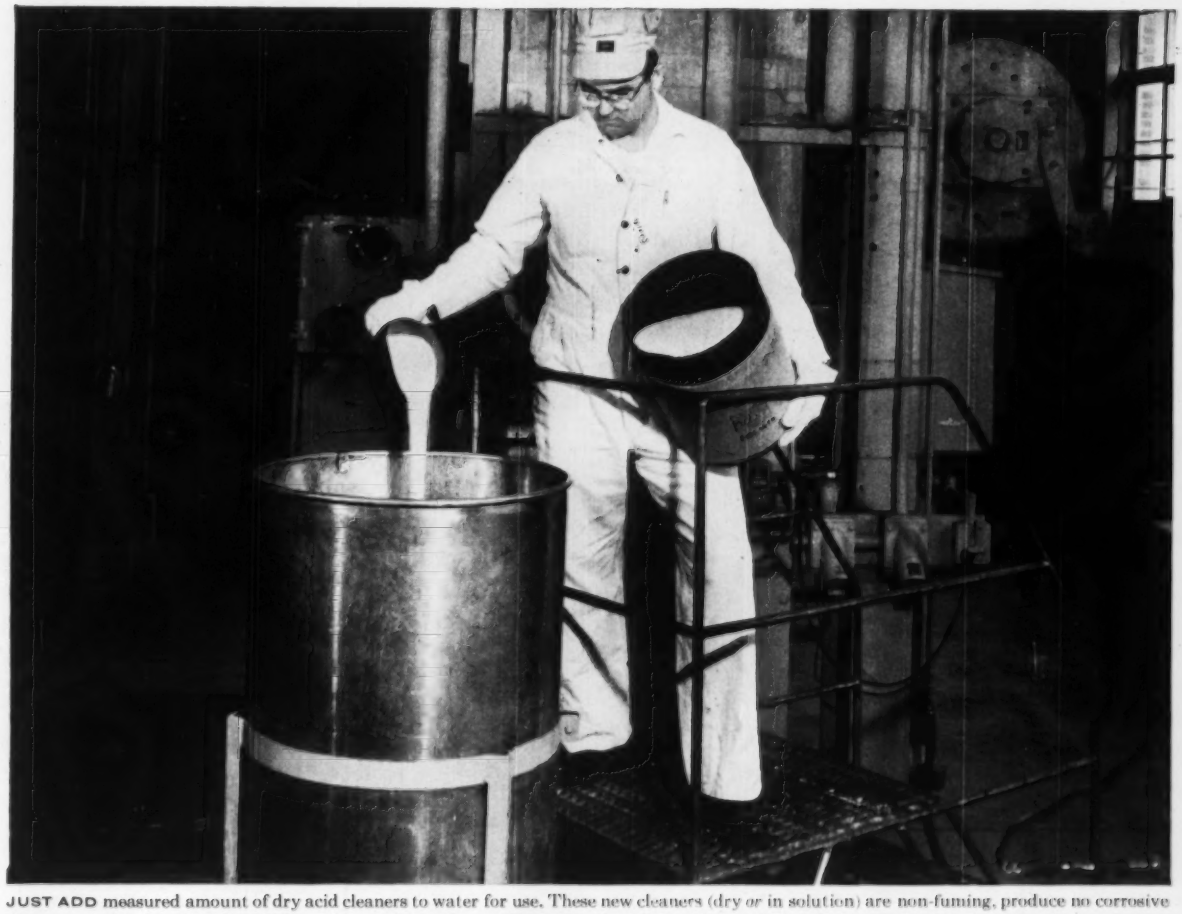
PIPE THREAD PROTECTORS used for internal thread protection and as hole plugs. *Protector Products, Inc., Dept. HPAC, 2156 W. 15th St., Cleveland 13, Ohio.* Plug-protectors available in pipe size increments 1/8 to 3 in. Threaded holes can be protected in transit or in processing by properly sized closures. Suggested uses: protection of bared polished, plated or painted internal surfaces ground; temporary sealing of valve seats; tubes and tube fittings; sealing in oil grease and rust-proofing compounds for shipping; masking surfaces during plating, coating, painting, other finishing operations.

STAPLER designed for heating, piping, and air conditioning contractor — *Markwell Mfg. Co., Inc., Dept. HPAC, 200 Hudson St., New York 13.* "L3-CS has outward spread staple leg for greater holding power in light weight duct installations, facings, asbestos. "L3D" (9/16 in. leg) regular or cement staples intended for use fastening facings, including reinforced asbestos, vapor barrier paper and muslin. Company's bronze or tinned copper rustproof staples fasten underground and outside pipe insulation and protective coverings.

ALUMINUM TUBE for heating, air conditioning applications—*Wolverine Tube, Div. of Calumet & Hecla, Inc., 17200 Southfield Rd., Allen Park, Mich.* "Versatube" sizes range 1/8 to 5/8 in. OD in aluminum drawn tube. Applications include instrumentation and air lines, connecting lines for pumps, oil burners, water heaters.

JOINT SEALER for use in preventing leaks in equipment and lines —*Highside Chemicals, Inc., Dept. HPAC, Clifton, N. J.* "Leak Lock" joint sealer especially recommended by manufacturer for preventing leaks of reactive substances such as gasoline, oil, petrochemicals, refrigerants.

(*Continued on page 214*)



JUST ADD measured amount of dry acid cleaners to water for use. These new cleaners (dry *or* in solution) are non-fuming, produce no corrosive gases—can often be added directly to equipment being cleaned. There's no danger of spillage or broken bottles, no hard-to-handle carboys to return.

For safer, easier equipment cleaning

DRY ACID CLEANERS

based on Du Pont Sulfamic Acid

New cleaning compounds made with sulfamic acid are sold and handled *dry*—no hazardous liquids to ship or store. Dry or dissolved in water for use, they create no fumes. Yet these cleaners have all the penetrating power of hydrochloric acid with far less corrosive effect.

Sulfamic acid-based cleaners remove hard water scale and other mineral deposits from industrial equipment such as air-conditioning and ice-making units, food-processing vessels, steam boilers, milk evaporators and pasteurizers, bottle-washing machines, marine evaporators and heat exchangers. Cleaning action is fast, thorough.

We'll gladly send you more information about sulfamic acid-based cleaners and the names of formulators who offer these new compounds. Mail coupon today.

SULFAMIC ACID

DU PONT

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.),
Grasselli Chemicals Department,
Room N-2533, Wilmington 98, Delaware

E. I. du Pont de Nemours & Co. (Inc.)
Grasselli Chemicals Dept., Rm. N-2533HP
Wilmington 98, Delaware

Please send me ☐ free booklet about sulfamic acid-based cleaners, ☐ names of formulators offering these new compounds.

Name_____

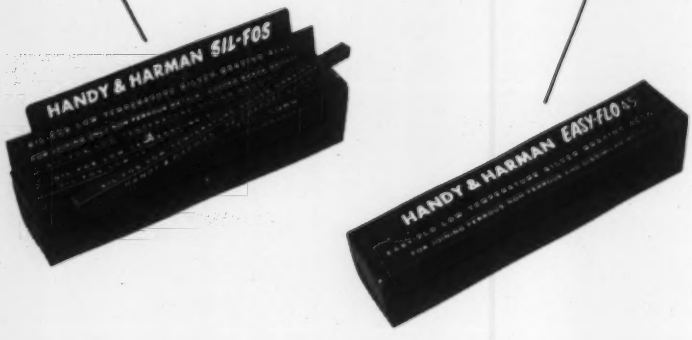
Firm_____ Title_____

Address_____

City_____ State_____

SIL-FOS—25 individual cartons per case containing 20 sticks per carton; .050″ x 1/8″ x 20″.

EASY-FLO 45—25 individual cartons per case, 17 pieces per carton. 1/16″ diameter wire in 20″ lengths.



New small packages of Easy-Flo and Sil-Fos

Low cost... Buy what you need... USE what you Buy!

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NOW...WELD OR BRAZE FOR FASTER, LOWER COST PROCESS LINE ASSEMBLY

Speedline® ALIGNING CONNECTORS ALSO INSURE POSITIVE PIPE ALIGNMENT

No pipe misalignment or "icicles" at joints with Speedline Stainless Steel Aligning Connectors. This inexpensive connector fits over stainless pipe and *Speedline Fittings*, to permit speedy welding or silver brazing of tight, leakproof, socket type joints. In-place preassembly for positive alignment *prior* to welding or brazing, reduces installation time and costs for the most complicated process piping systems.

Speedline Aligning Connectors also make it easy to tie in low cost, light wall Schedules 5 or 10 stainless pipe and *Speedline Fittings* with existing heavy wall lines. The extra straight section on *every* end of *every* Speedline corrosion resistant fitting allows for *direct* assembly of Aligning Connectors to any or all ports of the fittings.

Learn how Speedline Aligning Connectors and the *complete line* of Speedline stainless steel fittings can provide process piping economy and efficiency never possible with conventional fittings. Write for a copy of "Speedline Catalog" today, at no obligation.

Speedline® STAINLESS STEEL FITTINGS
THE NEWEST THING IN PIPELINE ECONOMY

® REG. T.M. OF HORACE T. POTTS COMPANY

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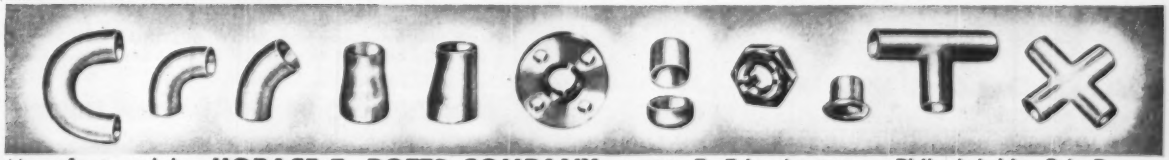
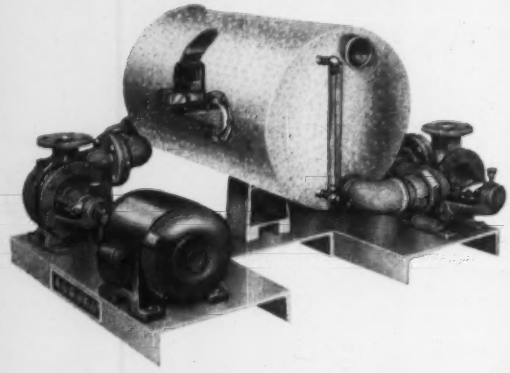


Manufactured by **HORACE T. POTTS COMPANY** • 576 E. Erie Avenue • Philadelphia 34, Penna.

HANDLES HOT WATER PERFECTLY

Will not vapor bind...or lock!



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HORIZONTAL CONDENSATION RETURN UNITS

These horizontal units are used wherever the returns are above the boiler room floor level. Because these Aurora turbine-type pumps are capable of pumping condensate returns with entrained vapor, they positively will not vapor bind. The free-running clearance of Aurora Apco's one moving part, the impeller, means that expansion due to heat does not cause metal-to-metal contact.

The suction equally distributes hydraulic pressure to both sides of the multi-vaned impeller, eliminating end thrust. These Aurora Apco units automatically adjust to varying capacity and pressure conditions.

AURORA Always PUMPS

FOR MORE COMPLETE DATA, WRITE FOR BULLETIN H-113.

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS ST. AURORA • ILLINOIS

EQUIPMENT DEVELOPMENTS

Continued from page 210

ELECTRODES in two new types—*International Nickel Co., Inc., Dept. HPAC, 67 Wall St., New York.* "Inco-Weld A" wire designed to give predictable, high quality automatic and manual inert gas welds in 95 percent of dissimilar metal combinations. "Inco-Hard 1" is metal arc welding electrode for applying hard protective surface to low alloy steels or cast irons which are subject to severe abrasive conditions.

REPRODUCING MACHINE developed to make blue or black line prints from translucent originals—*Blu-Ray, Dept. HPAC, 301 Main St., Ivoryton, Conn.* Unit has 42 in. capacity, design to accommodate low volume print requirements with controls that regulate printing speeds to 4 ft per min. Controls also allow latitude of background color. Can be operated from 12 volt vehicle battery for use in field.

FILTER REPLACEMENT designed to provide more efficient air filtration in all size, model window room air conditioning units—*Fiber Bond Corp., Dept. HPAC, 2237 S. LaSalle St., Chicago.* Acrylic fiber filter has high dust holding capacity, designed to last longer. Irregular cross section of fibers in filter cause sharp changes in air direction, high dust impingement on all fibers. ⫩

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Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- LOADING PLATFORMS and DOCKS
- SIDEWALKS • ROADS • DRIVEWAYS
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- RUNWAYS • RAILWAY SWITCHES

and other applications which HAVE proved that this modern method of snow removal.

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING. Fifty cents per copy.

$0.50 will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

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To keep pace with the growing demand for their complete line of industrial fasteners, Lamson & Sessions Co. are erecting this new, beautiful, highly functional plant on Cleveland's Tiedeman Road. Providing dependability and long life for the plant's all-important piping system will be tons of quality Youngstown Steel Pipe.

For years leading architects, as well as progressive plumbing and heating contractors, have specified Youngstown Steel Pipe because it's been their guarantee of trouble-free water piping systems.

Youngstown Steel Pipe is made of only the finest steel with exacting attention given to all sizing, threading and finishing processes. Close quality control of every step in Youngstown's fully integrated operations—from ore mining to finish threading—produces the best pipe obtainable—anywhere.

Your Youngstown Pipe Distributor is only a phone call away —why not contact him today?

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Engineer:	**The George S. Rider Company, Cleveland**
General Contractor:	**The Sam W. Emerson Company, Cleveland**
Plumbing & Heating Contractors:	**The Smith & Oby Co., Cleveland** **The Ed Sweeny Company, Cleveland**
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Manufacturers of Carbon, Alloy and Yoloy Steel

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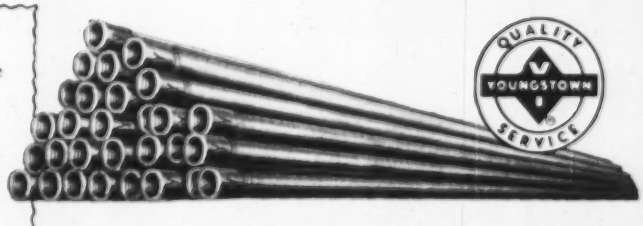
Specify Youngstown and secure these 7 Points of uniform goodness

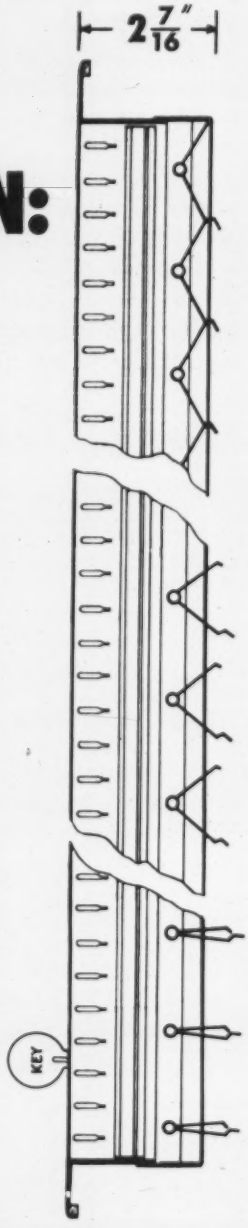
uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness



PROBLEM:

To find a commercial-type register with four way air-direction control plus volume control, that will work in standard 3¼" duct.

SOLUTION:



AIR CONTROL'S *Multi-Trol* Registers have exclusive **Shallo-Valve** – fit fine in 3¼" duct, leaving plenty of space for full air volume. And note how this patented butterfly valve action provides positive air volume control – assures even air distribution over register face at any setting. Seals *tight* when closed – can't whistle or rattle.

Ideal for both heating and cooling in commercial and de-luxe residential installations, Air Control's *Multi-Trol* registers feature fully adjustable face bars for 2-way or 4-way control of air pattern. Bars have air foil shape and are locked to side margins – can't come loose. Complete range of style and sizes. Attractive beige prime coat.

FREE '58 CATALOG SHOWING COMPLETE AIR CONTROL LINE — SEE YOUR JOBBER OR WRITE US.

AIR CONTROL PRODUCTS, Inc.
358 Center St., Coopersville, Michigan

RECENT TRADE LITERATURE...

▸ *AIR COMPRESSORS*—Catalog "37" gives details of new industrial air compressors in capacities of 25, 30, 40, 50 hp, single and two stage. Industrial air compressor design features included with detailed listings of components. Rating and data chart for single and two stage compressors also given. Other sections cover detail accessories, controls, air receivers. *Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford 10, Conn.*

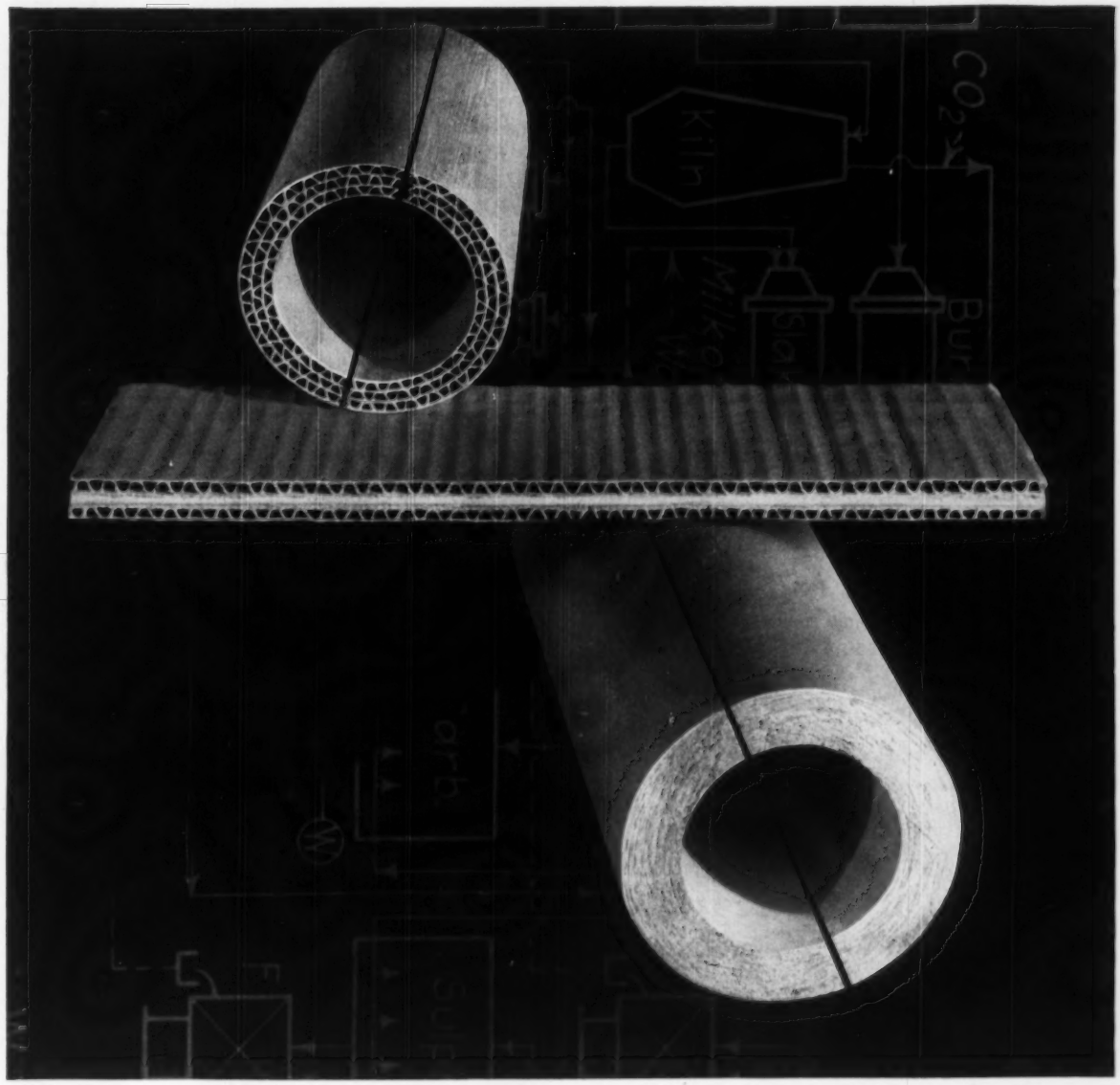
▸ *AIR CONDITIONING*—New, 40 page catalog lists physical data, installation details, descriptions of new line of units for air conditioning, heating in large industrial, commercial installations. Included in line are six sizes of fan coolers for floor and suspended mounting, six sizes of spray coolers, "Aeropass" condensers in standard casing and sectional construction. Also includes fan unit heaters to 1 million Btu per hr capacity, coil surface type air conditioners to 14,400 cfm air capacity. *Niagara Blower Co., Dept. HPAC, 405 Lexington Ave., New York 17.*

▸ *AIR FILTER*—New, 4 page publication describes, illustrates air filtering products for commercial and industrial applications. Standard filters shown for air conditioning and heating. *Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo 1.*

▸ *ASPIRATING CABINET*—Product sheet explains company's "Amco" aspirating cabinet, designed to provide accurate samples of air within processing area in textile mills, flour mills, tobacco plants, printing plants, other industries where close control of temperature, humidity is required. Cabinet continuously supplied with moving filtered air from space under control, encloses instruments required for temperature and humidity control. *American Moistening Co., Dept. HPAC, Cleveland, N. C.*

▸ *BLOWER UNITS*—New, 4 page technical bulletin gives specification data on "Vari-Basic" blower units with "Type CJ" spider-inlet wheels. Technical information includes 16 dimensions for four sizes in each of four discharge positions: top horizontal, bottom horizontal, upward, downward. Performance curves for each size give SP and bhp as functions of flow-rate output at four motor speeds. *Air Impeller Div., Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

▸ *BOILER ANTIFOAMS*—Bulletin "HSP-905" describes two of company's antifoams available: "C-1," a light colored water-soluble liquid, and "HP," a dry brown powder. Antifoams eliminate unscheduled outages by preventing carryover, minimizing blowdown and makeup, dispersing sludge. Case histories included



In food processing, as in other industries, "K&M" High-Pressure Insulations provide more precise process control.

"K & M" Pipe Insulations provide tighter heat control year after year!

Prescription for profits: "K&M" High- and Low-Pressure Insulations.

You've got four sales-making features with which to light up buyer enthusiasm: reduced fuel costs, ability to withstand temperature changes, a life outlasting that of the equipment, and speedy, easy installation.

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cool water for air conditioning

Two 16' 4-blade "AL-Metal" Propellers, ***efficiency-engineered*** to this application, keep working temperatures uniform in a large midwestern office building. By the people who designed and developed the famous "Macheta" Airfoil Propeller — acclaimed as ***industry's most efficient air-moving surface!***

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RECENT TRADE LITERATURE *Continued*

with chart giving rates of carryover with and without antifoam treatment. Methods of feeding discussed. *Hagan Chemicals & Controls, Inc., Dept. HPAC,* 323 *Fourth Ave., Pittsburgh.*

▸ *CORROSION RESISTANCE*—Bulletin "Form 501-T" outlines procedure for minimizing corrosion with chromate. Method recommended only where chemical testing facilities not available. *Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia.*

▸ *DUST COLLECTION*—Revised edition of 12 page bulletin "581" describes, illustrates wet type dust collector that uses no sprays, moving elements, water eliminators. *Dust Suppression & Engineering Co., Dept. HPAC,* 120 *S. Broadway, P. O. Box* 67, *Lake Orion, Mich.*

▸ *DUST CONTROL*—Bulletin "270-A2" describes operation, application of company's equipment in asphalt plant dust control. Basic units discussed are: "AAF Skimmer," "Amerclone," "Type N Roto-Clone," "Type K Exhauster." Specific situations given where each can be used to best advantage. *American Air Filter Co., Inc., Dept. HPAC,* 215 *Central Ave., Louisville* 8.

▸ *EVAPORATIVE CONDENSERS*—Condensed catalog "81C8b" describes manufacturer's products for refrigerant No. 12. Catalog gives basic information on sizes, ratings, overall dimensions, shipping weights of 15 different products including centrifugal blower ceiling units, floor units, air conditioning coils, evaporative condensers. *Recold Corp., Dept. HPAC,* 7250 *E. Slauson Ave., Los Angeles* 22.

▸ *FIRE PUMPS*—Single stage, horizontal multi-stage and vertical turbine multi-stage pumps are the subject of illustrated, 32 page bulletin. Publication gives descriptions, dimensions of types "AF," "ABF," "TUF," "TUTF" horizontal centrifugal fire pumps and types "M" and "MA" vertical turbine multi-stage fire pumps. Information, data for selection, application, installation of fire pumps for commercial and industrial applications presented. *Peerless Pump Div., Food Machinery and Chemical Corp., Dept. HPAC,* 2005 *Northwestern Ave., Indianapolis.*

▸ *GAS TURBINES*—Two new publications discuss performance of manufacturer's line of gas turbines. Illustrated, 28 page brochure "162" gives engineering, performance data on "Mark TA" model, 1150 bhp gas turbine for industrial, refining, process applications. Cutaway drawings, flow diagrams included; features de-

scribed. Second publication is 6 page, illustrated catalog describing models "302" and "305" gas turbines. Units are 8700-9300 bhp, used to drive pumps, generators, centrifugal compressors. *Clark Bros. Co., Dept. HPAC, 702 Lincoln Ave., Olean, N. Y.*

▸ *GATE VALVES*—Circular "No. 607," details newest valves in company's line. Circular describes engineering features, performance of "Fig. 8001," with screw ends, and "Fig. 8002," with socket welding ends. Each manufactured in sizes ½ through 2 in. at 800 psi, 850 F, and 2000 psi at 100 F. Made of forged carbon steel. *Lunkenheimer Co., Dept. HPAC, Box 360, Cincinnati 14.*

▸ *HEAT DIFFUSER*—Catalog "46 AF 91" explains company's new line of direct-fired heat diffusers. Various installations shown, described; applications for heating, ventilating outlined. Formula for selecting proper capacity unit included, with tables showing ratings and physical data, fan performance and resistances of filters, other accessories. *Unit Heater Dept., Carrier Corp., Dept. HPAC, 300 S. Geddes St., Syracuse 1, N. Y.*

▸ *HYDRAULIC CONTROL SYSTEMS*—Actuators, power units, hydraulic controls for industrial processes described in bulletin "GR-584." *General Regulator Corp., Dept. HPAC, 666 Fifth Ave., New York 19.*

▸ *HEAT EXCHANGER*—Two new publications describe manufacturer's "Therm-O-Wheel" rotary heat exchanger. Data sheet gives performance, dimensional data on unit in charts, tables, diagrams, photos, text. Bulletin on heat exchanger details application of product. *Therm-O-Wheel, Inc., Dept. HPAC, P. O. Box 577, Far Rockaway, N. Y.*

▸ *HYDRAULIC CYLINDER*—Bulletin covers company's line of hydraulic cylinders in data, descriptive text, charts, illustrations. Model "J" for 500-2500 psi service, model "H" for 3000-5000 psi service included together with details on cylinder accessories, air-oil devices, water-fitted cylinders, flange-fitted ports and new self-regulating floating cushion. Bulletin has 32 pages. *Miller Fluid Power Div., Dept. HPAC, 2040 N. Hawthorne Ave., Melrose Park, Ill.*

▸ *INSULATION*—Thermal, mechanical, physical, chemical characteristics of company's line of industrial insulations presented in new catalog. Includes data on high temperature spun-mineral wool insulating block blankets, pipe coverings, cements, mineral wool industrial felts, duct insulation. Products described,

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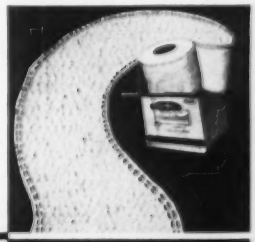
Grant Wilson
PRODUCTS

Complete the job...give it that "custom" look...that extra measure of efficiency!

FLEXI-DUCT...
The original flexible asbestos duct connector that stops *more* noise, costs little, installs easily. Meets National Board of Fire Underwriters' requirements.



DUX-SULATION...
The duct insulation specified when nothing but the best procurable is desired—costs more and worth it. A complete package—maximum efficiency, lifetime service.

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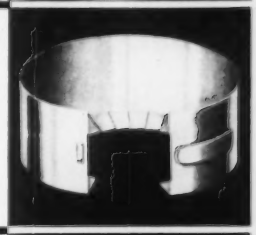
The all-aluminum adjustable cup that protects exposed ends of pipe covering—the finishing touch on all pipe insulating jobs



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Type A (asbestos) and Type C (canvas)—both punch-lock sealed to No. 1 prime galvanized metal. Underwriters' grade asbestos and canvas meets Fed. Specs. MIL-C-4177 and MIL-D-10860. Both 24 and 26 gauge metal, 25, 50 and 100 foot rolls.

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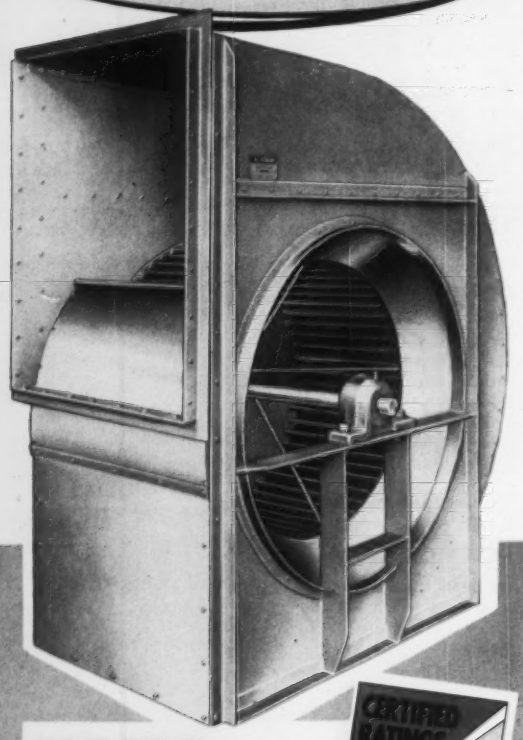

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- EFFICIENT
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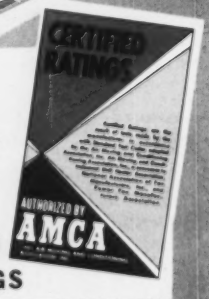

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Each fan is ruggedly built . . . fully equal to the job for which it is designed, and is backed by thirty-five years of know-how in manufacturing all types of air handling equipment.

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RECENT TRADE LITERATURE *Continued*

illustrated in 20 page catalog. Thermal conductivities, tables of recommended thickness of each material given for appropriate temperature ranges. Application instructions also included. *Industrial Insulation Div., Baldwin-Hill Co., Dept. HPAC, 500 Breunig Ave., Trenton 2, N. J.*

▸ *INSULATION BOARD*—"Asbestolux" insulation material is subject of 12 page brochure published by manufacturer. Booklet pictures, describes cross-section of applications in variety of buildings. Description of tested installation procedures accompanied by scale drawings. *North American Asbestos Corp., Dept. HPAC, 3210 Board of Trade Bldg., Chicago 4, Ill.*

▸ *MECHANICAL DRAFT FANS*—Catalog "1321" describes efficiency, noise level of airfoil blading for full range applications in three product lines: combustion air forced and induced draft ("Series 4000"); primary air for pulverized fuel injection ("Series 2100"); high pressure air supply for cyclone furnace boilers ("Series 2200"). Also includes general engineering data on each line. *Westinghouse Electric Corp., Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

▸ *METERS*—"Propeloflo" meter for liquids, "Shuntflo" meter for air are subjects of new bulletin "100-R1." Six pages of line drawings, cutaway views, technical data tables. *Builders-Providence, Inc., Dept. HPAC, 345 Harris Ave., Providence 1, R. I.*

▸ *MINIATURE THERMOCOUPLES*—New, 28 page catalog covers company's complete line of miniature thermocouples. Four basic designs for particular applications described, illustrated—gasket, bayonet, protected, shielded. Gasket thermocouples used for surface temperature measurements; bayonet thermocouples for applications requiring embedded measuring junction with spring loaded contact; protected thermocouples for protection against corrosive environments in measuring liquid, gases; shielded design used for measuring temperatures of moving gases. Ordering, installation instructions provided. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

▸ *MOTORS*—Price book and memorandum pad "Form EU-2" offered by company. Contains information, specifications, illustrations for its complete line of polyphase and single phase motors. Book contains 40 pages of text, illustrations, tables, with 8 note pages in back. *Wagner Electric Corp., Dept. HPAC, 6400 Plymouth Ave., St. Louis 14.*

RECENT TRADE LITERATURE *Continued*

▸ *PANCAKE MOTORS*—Bulletin "No. 2100" presents engineering information on flange type pancake motors of conventional radial air gap design intended for use on roof ventilating fans, other installations where space is important factor. Features cited: cast iron construction; factory lubricated bearings; quiet operation. Motors available from 1 to 15 hp; in sizes to 1½ hp construction is nonventilated, above that, fan cooled. *Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

▸ *PIPE CHART*—Wall chart reproduces essential pipe specification information on wall thicknesses, weight, OD of seamless and welded steel pipe under ASA schedules ⅛ to 24 in. Chart is 17 × 22 in. *Midcontinent Table Service, Inc., Dept. HPAC, 2120 Lee St., Evanston, Ill.*

▸ *PIPE HANGERS*—Illustrated 4 page bulletin presents information on line of pipe hangers, related accessories. Inserts, hangers, clamps, saddles, sockets, supports, other items included. *Elcen Metal Products Co., Dept. HPAC, 9325 King St., Franklin Park, Ill.*

▸ *PLASTIC PIPE CLAMPS*—New chart facilitates selection of clamp for three classes of plastic pipe in sizes ½ through 6 in. Chart is suitable for wall or counter use. *Wittek Mfg. Co., Dept. HPAC, 4307-37 W. 24th Pl., Chicago* 23.

▸ *RECEIVER RECORDER*—Product specification "E12-5" details newly developed plug-in components for company's recorder. Twelve types of receivers, controllers, retransmitters, direct measuring devices from which recorder may be custom built. *Bailey Meter Co., Dept. HPAC, 1050 Ivanhoe Rd., Cleveland* 10.

▸ *RELIEF VALVES*—Features of manufacturer's disc relief valves for steam systems described in bulletin "5200-A." Specifications for vertical, horizontal, angle styles in sizes 4 to 48 in., zero to 25, zero to 100 psig pressure given. Installation diagrams, data on selecting and specifying also included. *Cochrane Corp., Dept. HPAC, 3131 N. 17th St., Philadelphia* 32.

▸ *SEALING COMPOUND*—Illustrated bulletin describes company's sealing compound for fixing bolts, studs, pipe, gaskets. "Armite" consists of 70 percent metallic lead suspended in nonvolatile hydrocarbon vehicle, free of fillers, drying agents, other foreign materials. Seizure or galling prevented at extremely low or high temperatures: seals from −350 to 2987 F. *Armite Laboratories, Dept. HPAC, 6609 Broad St., Los Angeles* 1.

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in Modernizing a Duct System

Seal it with Arno Ductape. Unsealed ducts can't be efficient. A test in a typical home increased air flow at room registers an average 21%—simply by sealing all accessible duct joints with Arno Ductape, which sticks instantly and holds permanently.

Customers like and gladly pay for results like this. It's a low-cost service that makes friends—and profits, too.

If you are not now using Arno Ductape why not make your own test of the income and goodwill opportunities of this service? We'll gladly send a sample roll for demonstration.

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ADHESIVE TAPES, INC.
Subsidiary of The Scholl Mfg. Co., Inc.

Arno Adhesive Tapes, Inc., 4140 Ohio Street, Michigan City, Indiana

Check them off!

ALL of THESE FEATURES ARE FOUND Only on DeZurik Valves

- **TIGHT SHUT-OFF EVERY TIME,** without lubrication, in spite of solids in the flow.
- **EASY OPERATION,** even in large sizes, with exclusive Eccentric Action
- **GOOD THROTTLING CHARACTERISTICS,** without whine, whistle or chatter
- **NO METAL-TO-METAL SEATS,** no seat rings to replace
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- **NO CUMBERSOME TOPWORKS,** results in more compact installations
- **LOW PRESSURE LOSS** from straight-thru flow

These are just a few of the advantages of DeZurik Valves. In sizes ½" thru 20", and in the full range of body materials, with any one of a full complement of operators, you get longer life, more dependable operation with less trouble at lower cost with DeZurik Valves. See the DeZurik representative in your area, or write

DeZURIK CORPORATION
SARTELL, MINNESOTA

RECENT TRADE LITERATURE *Continued*

▸ *SINGLE PHASE MOTORS*—Details on 1/3 to 1 hp single phase motors for belt driven fans and blowers given in new brochure "Sec 9-820." Types, ratings, voltages, operational characteristics, mountings, dimensions all reported. Illustrations show design, construction details of each component used. *A. O. Smith, Electric Motor Div., Dept. HPAC, 531 N. Fourth St., Tipp City, Ohio.*

▸ *SMALL A-C MOTORS*—Line of small a-c motors for variety of applications discussed in 4 page bulletin "GEC-1502." Motors available in 3, 3⅞, 4⅞ in. diam, including eight starting types, 2, 4, 6 pole constructions and ratings from 5 mhp to ½ hp. Motor selection chart shows over 200 rating combinations available in three frame sizes. Motor dimensions, construction features, typical speed-torque curves of various starting types, connection diagrams also given. *General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

▸ *SOLAR HEAT CALCULATOR*—Slide chart calculator designed to give detailed data on heat gain through windows. Calculator consists of chart cover with window slots and data insert cards. Data insert cards prepared in 4 deg latitude steps from 26 to 50 deg and for 13 deg and the equator. Calculator can be adjusted for latitude, season, window orientation, time of day. Available for $1.00 each; attach check to letterhead. *Reflectal Corp., Dept. HPAC, 310 S. Michigan Ave., Chicago 4.*

▸ *SQUIRREL-CAGE MOTORS*—Company's increment motor, starter combination for squirrel-cage motors is subject of 4 page, illustrated bulletin. Units especially designed for polyphase motor applications where starting current is limited by power company regulations, other factors. Available in high or normal torque designs at 20 through 200 hp. *Wagner Electric Corp., Dept. HPAC, 6400 Plymouth Ave., St. Louis 14.*

▸ *STAINLESS TUBING*—New 8 page "TB-365A" folder explains use of stainless steel mechanical tubing. Included are industry tolerance tables covering diameter, ovality, wall thickness, straightness, length and machining allowances for both seamless and welded stainless steel mechanical tubing. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▸ *STEAM PIPING*—"Croloy 1515N—An Austenitic Heat Resistant Alloy for Severe Tubular Application at Elevated Temperatures," is title of bulletin "TR-555," a reprint of technical paper describing testing program, outlining characteristics of product. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

RECENT TRADE LITERATURE *Continued*

▸ *TEMPERATURE CONTROLS*—Technical literature describes manufacturer's "C11" and "E32N" temperature controls. "C11" is wide range temperature control with water, vibration, shock resistant features, including bronze case, steel bearing surfaces and cover gasket. "E32N" is indicating temperature control with calibrating mechanism for replacement of thermal assembly in field with no loss of calibration accuracy, according to manufacturer. *United Electric Controls Co., Dept. HPAC, 79 School St., Watertown, Mass.*

▸ *TUBING*—Bulletin "TB-420," entitled "Quality Control," describes various testing, inspection methods used during manufacture of line of seamless and welded carbon, alloy and stainless steel tubular products. Booklet explains how inspection, testing techniques are integrated into manufacturing process. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

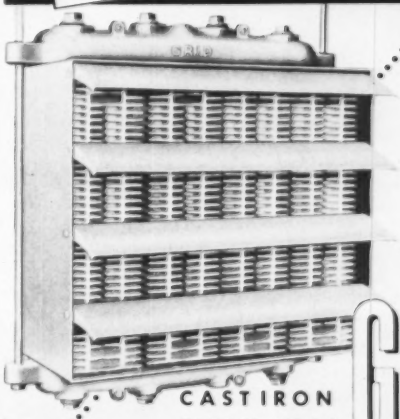
▸ *THERMAL INSULATION*—Method devised, offered by National Bureau of Standards for calculating air space values is found in appendix of booklet "BMS 151." Method applicable in dealing with parallel foils forming independent series of air spaces or with air spaces adjacent to fibrous insulations. *Infra Insulation, Inc., Dept. HPAC, 525 Broadway, New York.*

▸ *UNIT VENTILATOR*—Illustrated 6 page bulletin describes company's "Praetorian" unit ventilators, designed, built for classroom heating, ventilation, cooling. Charts give complete specification data, diagram details, dimensional information. *Valve-blower Co. of California, Dept. HPAC, 13729 E. Rosecrans Ave., Santa Fe Springs, Calif.*

▸ *VALVE CONTROLS*—"No. 5811" is designation of new, 20 page design manual on company's line of manual remote valve controls. Design data given on both flexible shaft and standard reach rod valve controls. *Stow Mfg. Co., Dept. HPAC, 443 State St., Binghamton, N. Y.*

▸ *VALVE CONVERTER*—Automatic valve actuating conversion unit described in new, 4 page catalog. "Valvmatic" converts hand operated valves to motor operation. Actuated electrically, "Valvmatic" will open, close windows, other remote units, as well as operate valves. Position and torque limits provided for both rotation directions to prevent valve injury; in event of power failure, pulling two pins restores valve to manual operation. Design, metallurgy, maximum pressure differential data included in catalog. *C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh Sts., Philadelphia 32.* ≠

Corrosion in heating equipment Ends



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CAST IRON STEAM HEAT TRANSFER SURFACE

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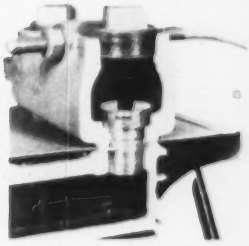

Top and bottom manifolds connected to fin sections by special threaded nipple.

You once and for all eliminate internal electrolytic corrosion because all metals in GRID Cast Iron Steam Heat Transfer Surface that are in contact with steam are similar . . . not 2 or 3 different metals that promote corrosion to cause leaks and breakdowns. GRID Cast Iron Steam Heat Transfer Surface also eliminates external corrosion because its cast iron construction resists acids or fumes in the air. When corrosion in heat transfer equipment ends, maintenance ends. GRID Cast Iron construction eliminates the use of reducing valves where high steam pressures are used. It is designed to withstand steam pressures up to 250 P.S.I. . . . 450° temperature. GRID Cast Iron Steam Heat Transfer Surface does away with replacement costs because GRID is built to last for years . . . operating successfully without maintenance in many plants since 1929.

All cast iron one-piece single chamber fin section in Models 1000 and 1200 . . . wide fin spacing.

All cast iron one-piece double fin section in Models 1500 through 3000 . . . wide fin spacing prevents clogging . . . easily cleaned.

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OUR 75TH YEAR 1882 TO 1958

WHO'S WHAT...

(New personnel, promotions)

▸ *INGERSOLL STEEL DIV. of BORG-WARNER CORP.*—Harold G. Ingersoll, president and general manager.

▸ *DRYOMATIC CORP.*—Anthony Hass, president.

▸ *TENNEY ENGINEERING, INC.*—Saul S. Schiffman, chairman of the board of directors.

▸ *BUFFALO FORGE CO.*—Theodore M. Dillaway and Georg B. Kellogg, both elected to board of directors.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—Woodford D. Miller, vice president, now general manager of *FULTON SYLPHON DIV.*

▸ *MIDWEST PIPING CO.*—Fred J. Blum, executive vice president and secretary.

▸ *PITTSBURGH GAGE AND SUPPLY CO.*—C. J. Ramsburg, Jr., executive vice president.

▸ *CONTROLS CO. OF AMERICA*—J. Philip Starbuck, vice president in charge of industrial relations.

▸ *JOHN WOOD CO.*—Walter S. Sepura, vice president and plant manager of company's heater and tank division.

▸ *CRUCIBLE STEEL CO. OF AMERICA*—Dr. M. J. Day, vice president—technology; William R. Howell, assistant to the vice president—operations; W. E. Gregg, director of technical development; Dr. W. L. Finlay, director of research; D. I. Dilworth, Jr., director and coordinator of metallurgical policies.

▸ *FLEXONICS CORP.*—Eugene Ransom, general manager of industrial hose division.

▸ *GENERAL ELECTRIC CO.*—James M. Crawford, vice president and general manager of motor and generator division.

▸ *PRAT-DANIEL CORP.*—Tung K. Lau, chief engineer.

▸ *ORR & SEMBOWER, INC.*—Anthony J. Szynkiewicz, plant manager.

THE *NEW* MILLER ALL-IN-ONE SPOT WELDER for ALL NUMBER ONE WELDS

LECTRO SPOT

Built-in Timer Turns the Trick

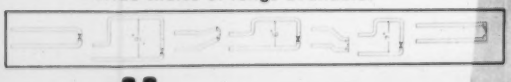
Sheet metal shops ready for new speed, economy and completely uniform spot welds will want the new Lectro Spot. Here's why:

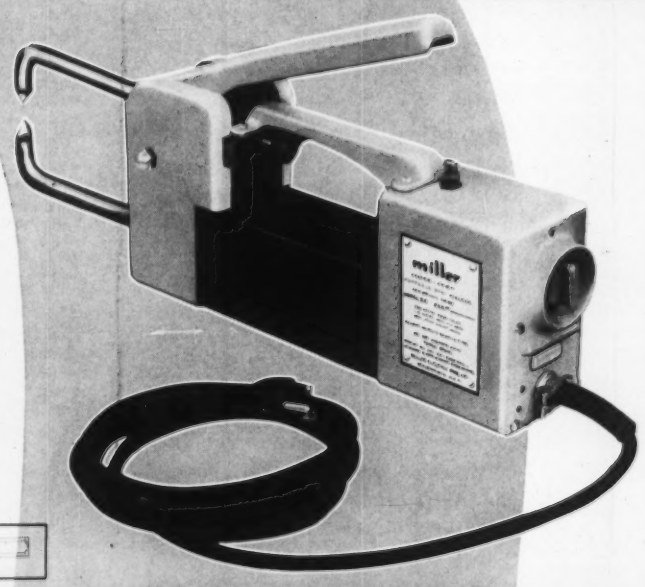
Operator depresses lever and,
1 — 2 — 3:
Tongs grip work at pre-set pressure;
Starter switch is actuated;
Weld sequence starts and stops automatically;
Result: EVERY WELD IS IDENTICAL!

Pressure adjustment and electronic timer controls instantly accessible.

Three models in 115 or 230 volts weld mild steel of 1/8" to 3/16" combined thickness; 1.5 KVA weighs 29 lbs., 2.5 KVA weighs 39 lbs.

Wide choice of tongs available.





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WHO'S WHAT

Continued

▸ *GRANT WILSON, INC.*—Larry E. Harnisch, vice president, operations; Edwin H. Trudan, assistant treasurer.

▸ *ARKLA AIR CONDITIONING CORP.*—Robert K. Eskew, director of engineering, research and development.

▸ *RESEARCH-COTTRELL, INC.*—Ralph L. Chamberlin, director of engineering.

▸ *WARREN PUMPS, INC.*—Walter B. Eklund, operations manager; Charles F. Dexter, sales manager, industrial division, replacing Mr. Eklund.

▸ *ALLIS-CHALMERS MFG. CO.*—Charles W. Parker, Jr., director of sales promotion; A. R. Tofte, publications and industrial press department; J. W. Murphy, manager of the advertising department.

▸ *RELIANCE ELECTRIC AND ENGINEERING CO.*—E. L. Bronold, sales manager of apparatus sales; C. Porter Packard, sales policy manager.

▸ *GENERAL CONTROLS CO.*—Robert E. Cody, manager of advertising and public relations.

▸ *FURNAS ELECTRIC CO.*—Dale Willcox, project engineer.

▸ *RHEEM MFG. CO.*—Leonard Arnold, manager of employee relations.

▸ *SQUARE D CO.*—Mitchell P. Kartalia, general manager of marketing division.

▸ *TRANE CO.*—John B. Custer, manager, aircraft heat exchanger sales department; William H. Stahlheber, manager, process heat exchanger sales department; Wesley W. Wright, sales engineer.

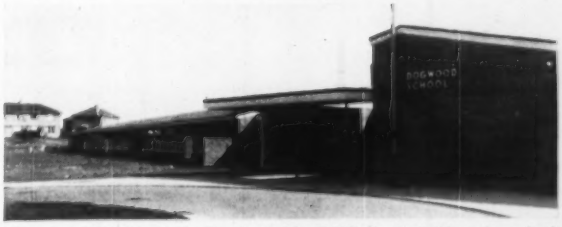
▸ *INDUSTRIAL ACOUSTICS CO., INC.*—Richard A. Heindel, assistant manager in engineering, design and promotion of noise control products in air conditioning and ventilating field.

▸ *DETROIT CONTROLS DIV., AMERICAN-STANDARD*—New product planning managers are: F. Y. Carter, air conditioning controls; W. C. Dorr, appliance controls; J. F. Page, "TyniSwitch" products; R. W. Miller, bronze valve products; H. L. Walker, industrial controls.

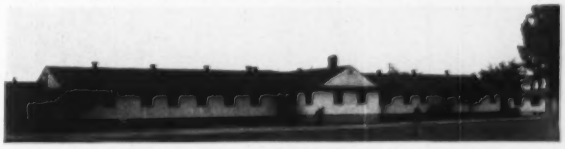
LARGE OR SMALL

LO-BLAST

POWER GAS BURNERS COST LESS TO OPERATE



Low cost installation and operation dictated Lo-BLAST selection in this modern school.



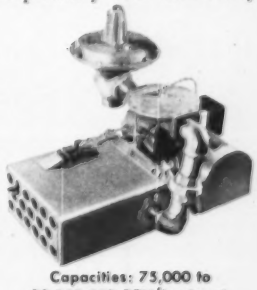
Sixteen Lo-BLAST Burners at this army camp burn 30,000 cu. ft./hr. of gas when all are operating.

In this development of 472 small homes, Lo-BLAST Economite Burners replaced oil burners originally installed.

Lo-BLAST Burners cost on an average of 10% less to operate. They use an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air from start to finish of each run. Operation is always independent of natural draft conditions—ideal for down draft boilers.

Cost less to install

Lo-BLAST Burners eliminate the need for high chimneys—inshot design and complete factory assembly reduce maintenance and installation costs. Each unit is factory tested on gas before shipment.



Capacities: 75,000 to 20,000,000 BTU/hr. input.

Write for literature

MID-CONTINENT METAL PRODUCTS CO.

1960 N. Clybourn Ave., Chicago 14, Ill.

WHO'S WHAT

Continued

▸ *BRYANT MFG. CO.*—Gilbert A. Peck, branch operations manager.

▸ *NIAGARA BLOWER CO.*—Louis F. Prossen, engineer.

▸ *NATIONAL SUPPLY CO.*—Jack K. Sutter, manager of tubular sales; Stuart F. Hatch, sales manager, standard pipe products.

▸ *VAPOR HEATING CORP.*—H. Clark Corbin, director of public relations.

▸ *WOLVERINE TUBE DIV., CALUMET & HECLA, INC.*—John M. Dumser, director of sales, elected to board of directors of Plumbing-Heating-Cooling Information Bureau.

▸ *COPELAND REFRIGERATION CORP.*—Edward J. Czarnecki, production control manager; J. Bernard Goodwin, production staff, special assignments.

▸ *OTM CORP.*—J. C. Smith, sales manager.

▸ *ALPHA PLASTICS INC.*—James P. Kelleher, manager of sales.

▸ *WHITE-RODGERS CO.*—Gerry Powell, sales manager.

▸ *DELAVAN MFG. CO.*—William B. Spargur, sales manager of agricultural and industrial sales division.

▸ *BABCOCK & WILCOX CO.*—Leon B. Wohlgemuth, general sales manager.

▸ *AIRTEMP DIV. of CHRYSLER CORP.*—Robert L. Forsberg, director—market research.

▸ *BORG-WARNER CORP.*—Donn Sutton, director of public relations and advertising.

▸ *CLEAVER-BROOKS CO.*—John Nash, sales manager for *PROGRESS AND MONITOR BOILER DIV.*

▸ *BOHN ALUMINUM & BRASS CORP.*—Paul C. Bailey, manager of sales and manufacturing for company's brass division.

JUST OFF THE PRESS

This new Bulletin, with 182 photographs, diagrams and tables, is a handbook of refrigeration in all its commercial and industrial phases —air conditioning, ice making, quick freezing, cold storage, process work, etc.

Details of heavy-duty compressors, multi-cylinder compressors, booster systems, condensers, coolers, coils, controls, valves and auxiliaries are fully explained.

If your business uses cooling equipment, you'll profit from reading this informative 32-page booklet. Available in English, Spanish and Portuguese.

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WRITE FOR YOUR FREE COPY OF BULLETIN 80 TODAY TO:

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

WHO'S WHAT

Continued

▸ *CHEMETRON CORP.*—Gene Wedereit, director of advertising and public relations.

▸ *FLUID CONTROLS INSTITUTE*—Dean E. Madden, vice president of A. W. Cash Valve Mfg. Corp., elected president. Elected vice presidents were: James R. Lawler, Lawler Automatic Controls, Inc.; Fred E. Weldon, General Controls Co. Robert McCormick, Automatic Switch Co., elected secretary; Paul K. Rogers, Jr., Skinner Chuck Co., elected treasurer.

▸ *INSTITUTE OF HEATING AND AIR CONDITIONING INDUSTRIES*—Jack Pennell, president of Jack Pennell Heating Co., and T. L. Van Law, Southern California Edison Co., both appointed to board of directors.

▸ *OIL HEAT INSTITUTE OF AMERICA, INC.*—J. Verne Resek, president; Stanley Czarnecki, vice president; Fred Heaney, vice president; G. M. Marin, vice president; R. H. L. Becker, secretary-treasurer.

▸ *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS*—Virgil A. Good, Burnham Corp., chairman; M. C. Reed, Dunkirk Radiator Corp., vice chairman; Robert E. Ferry, reelected general manager and treasurer.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *NIAGARA BLOWER CO.*—William R. Hollinger, district engineer in Philadelphia; Tom L. Larson, district engineer in Baltimore and Washington.

▸ *BARRY BLOWER CO.*—Ronald Newton, Decatur, Ga.; Whitney M. Kerr Co., Kansas City, Mo.; E. M. Tarnoff Co., Norwalk, Conn.; Chas. M. Setzer & Co., Charlotte, N. C.; E. H. Bellard & Associates, Cleveland; all appointed manufacturer's representatives.

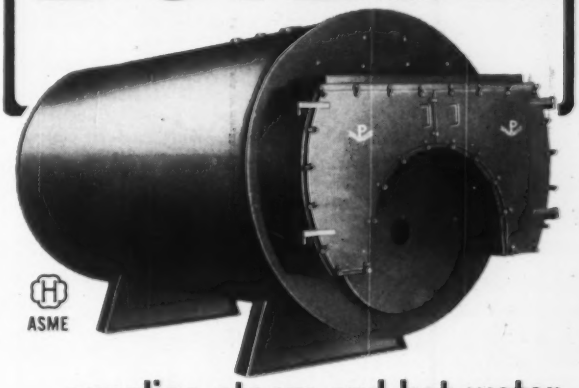
▸ *CONOFLOW CORP.*—Darling Co., Wheat Ridge, Colo., manufacturer's representative in Colorado, Wyoming, southwestern Nebraska.

▸ *DeLAVAL STEAM TURBINE CO.*—A. L. Foltz, Jr., manager of Chicago district office; J. F. Donovan, manager of Detroit district office; W. H. Mouquin, manager of New York district office.

▸ *NATIONAL SUPPLY CO.*—R. W. Mueller, Jr., district manager, Pittsburgh district sales office.

FULL "WET-BACK" CONSTRUCTION

SCOTCH TYPE LOW PRESSURE BOILER



. . . supplies steam and hot water for institutions, commercial and industrial installations

13 SIZES: Steam 5,470 to 42,500 sq. ft. Water 8,750 to 68,000 sq. ft. Working pressures: steam 15 lbs.; water 30 lbs.

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- architects and engineers can specify this boiler with confidence, assured that all the necessary heat and hot water requirements will be delivered
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- boiler is supported by reinforced saddles and rests directly on boiler room floor, no foundation to build . . . no pitting or brickwork required
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- combustion chamber is completely surrounded by water-backed heating surfaces . . . result is less heat loss, higher operating efficiencies

Write for new Scotch Type Boiler literature, get complete details and specifications—offices in principal cities

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Portmar Boiler Company Inc.
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WHO'S WHAT

Continued

▸ *ACME INDUSTRIES, INC.*—Terrance W. McGuire, central regional manager; C. L. Rutledge, Jr., southern regional manager.

▸ *TRION, INC.*—R. M. Toucey, manufacturer's representative in Pittsburgh area.

▸ *FRAM CORP.*—C. B. Gouert, Jr., West Coast industrial sales manager; P. S. Innis, industrial sales manager for Southwest; C. N. Haskins, industrial sales manager for Middle West; J. S. Evans, industrial sales manager for Northeast, including New England.

▸ *KENT CO.*—George T. Davis, southeastern sales representative in Columbia, S. C.

▸ *KEROTEST MFG. CO.*—Wallace R. Williams, sales representative in company's new California sales office and warehouse, 3151 E. 12th St., Los Angeles 23.

▸ *OTM CORP.*—New branch office in Denver.

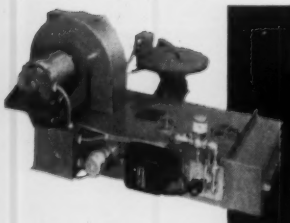
▸ *THERMO-PRODUCTS, INC.*—Deane W. Challis, sales representative for Wisconsin.

▸ *DRESSER MFG. DIV. of DRESSER INDUSTRIES, INC.*—Lew B. Phillips, district manager, gas industry sales for the Great Plains states with headquarters in Kansas City, Mo.

▸ *RUUD MFG. CO.*—Masda Corp., Newark, N. J., northern New Jersey distributor.

▸ *TRANE CO.*—Robert W. Strickland, manager of Providence, R. I., sales office; E. D. Cambon, Jr., sales engineer in New Orleans sales office; R. E. Weisenfels, sales engineer in St. Louis sales office; M. L. Franzel, sales engineer in Los Angeles sales office. Pam Oil Co., Inc., Brooklyn; North Shore Sheet Metal Co., East Northport, N. Y.; Tirico Refrigeration Service, Long Island, N. Y.; Kyte Heating and Air Conditioning Corp., Long Island, N. Y.; Corona Heating Co., Evansville, Ind.; Art Campbell, Philadelphia; Page Sheet Metal, Inc., Weymouth, Mass.; all named as authorized sources for company's products.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—R. E. Fitzpatrick, district sales manager in Cleveland for the *FULTON SYLPHON DIV.*; Lewis V. Smith, district sales manager in Cleveland for *ROBERTSHAW THERMOSTAT DIV.*

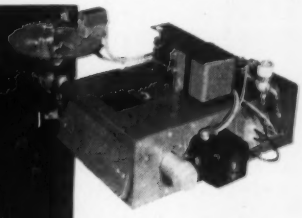


POWER OR ATMOSPHERIC

Multuri Burners

that EXCEED Standards of

EFFICIENCY! PERFORMANCE! SAFETY!



Power Multuri burners available in standard units with input capacities to 19,600,000 BTU's. Larger burners or special adaptations available.

Multuri Burners available in 4 to 54 mixers. Standard capacities 700,000 to 9,450,000 BTU/hr. Higher capacites available.

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ROBERTS-GORDON POWER MULTURI GAS BURNERS

Ideal for commercial and industrial boilers, such as scotch marine, steel firebox, downdraft, refractory types, warm air furnaces, drying units, etc. Power Multuri burners can often be used in conjunction with presently installed stokers or oil burners, permitting quick changeover to auxiliary standby fuel, and can be operated with natural or induced draft.

ROBERTS-GORDON MULTURI (Atmospheric) BURNERS

A PREMIX TYPE GAS BURNER, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Controlled flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency.

Multuri Burners are completely wired and Assembled — Ready for Immediate Installation. Simple to Install, Adjust, Operate!

Write for detailed information–or for a questionnaire listing all the data necessary for correct specifications and efficient installation.

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Gas Heating Equipment

- FURNACES
- COOLING UNITS
- BOILERS
- UNIT HEATERS
- GAS BURNERS

WHO'S WHAT

Continued

▸ *SOLAR AIRCRAFT CO.*—Southport Engineering Co., sales representative in the southern California area; Piepenbrink & Shoonhoven, Chicago, representative in northern Illinois, northwest Indiana, parts of southwest Michigan and southeast Wisconsin; Power Specialty Co., Houston, representative in Texas and the Louisiana Gulf area.

▸ *BUENSOD-STACEY, INC.*—Paller Engineering Co., Fort Wayne, Ind., representative.

▸ *H. K. PORTER CO., INC.*—David P. Wroten, district sales manager, southeastern territory, W-S Fittings Works, Forge and Fittings Div.

▸ *UNITED CORK COMPANIES*—Don D. W. Lambert, manager of New England division with offices in Albany, N. Y.

▸ *WOLVERINE TUBE, div. of CALUMET & HECLA, INC.*—Kenneth B. Shaw, wholesaler sales representative in Philadelphia metropolitan area.

▸ *ELECTRIC FURNACE MAN, INC.*—H. Lieblich & Co., New York, exclusive agent in the five boroughs of New York.

▸ *TUBE TURNS, div. of CHEMETRON CORP.*—Jack D. Tolliver, sales manager for the eastern region.

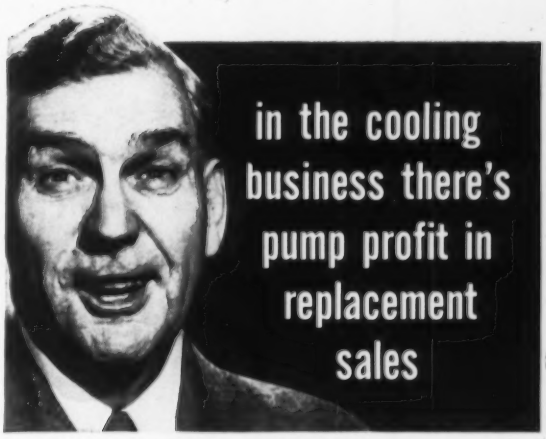
▸ *A. M. BYERS CO.*—Jones-Sylar Supply Co., Inc., Chattanooga, Tenn.; Independent Plumbing Supply, Dorchester, Mass.; Cobra Pipe & Coil, Elmwood, Conn.; Roberts Supply Co., Omaha; all new distributors.

▸ *CONOFLOW CORP.*—Gene D. Pribble Co., Los Angeles sales agent.

▸ *De LAVAL STEAM TURBINE CO.*—W. H. Mouquin, manager of New York district office;

▸ *DUNHAM-BUSH, INC.*—Robert H. Schulz, sales representative in Milwaukee sales office for northeast Wisconsin, upper Michigan, and the Michigan Peninsula.

▸ *RELIANCE ELECTRIC AND ENGINEERING CO.*—Edwin R. Campbell, branch manager of sales office at Tampa, Fla.



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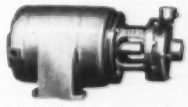
MYERS

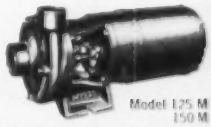
centri-thrift pumps

Ideal for all cooling-tower applications in air conditioning and refrigeration

Ruggedly built for continuous duty, the general duty Myers Centri-Thrift features an all bronze impeller, removable wearing ring, and stainless steel shaft. The line offers a full range of sizes: from 1" x 1¼" through 2" x 2½" and from ⅓ to 7½ horsepower. Capacities to 240 GPM, heads to 140 feet.

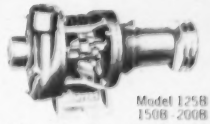


Model 150 M 200 M
Shown with rotary seal (available with stuffing box)



Model 125 M 150 M
Shown with stuffing box (available with rotary seal)

Model 100 M—Rotary seal only



Model 125B 150B-200B
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Myers® PUMPS

THE F. E. MYERS & BRO. CO.
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Myers®

TYPE AL furnace limit control

Adjustable and non-adjustable. Bimetal sensing element is maintained in a completely exposed position in the air stream for fast temperature response. Temperature calibration and differential can be preset to your specifications up to 300° F. Standard factory differential is 25° F. Can be supplied with a closer or wider differential on request. Adjustable feature at no extra cost. Standard range of adjustment is 90° F. 40° F. range also available. Furnished with either 3-inch (AL-3) or 7-inch (AL-7) probe.

NEW
THERM-O-DISC
THERMOSTATS
for furnace fan and limit control applications

TYPE AF furnace fan control

Available with either a 3-inch (AF-3) or 7-inch (AF-7) probe which maintains the bimetal sensing element in a completely exposed position in the air stream. This rapid response position of the sensing element, combined with a snap-acting switch mechanism, provides fast and efficient furnace fan control. Adjustable with a range of 90° F. Maximum temperature 300° F. Factory differential is 25° F. Can be supplied with a closer or wider differential on request.

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Therm-O-Disc

THERM-O-DISC, INCORPORATED mansfield, ohio

WHO'S WHAT

Continued

▸ *GENERAL ELECTRIC CO.*—A. S. Garven, branch manager for the air conditioning department in New Jersey area; I. W. Pittleman, branch manager for the air conditioning department in Cleveland area.

▸ *ILG ELECTRIC VENTILATING CO.*—A. Phelps Langtry, sales engineer in the Chicago sales office.

▸ *MIDWEST PIPING CO., INC.*—John Castleman, director of newly re-opened Atlanta sales office; Claude L. Doughman, director of newly re-opened Tulsa sales office; C. B. Moore and Cecil Hilliard, sales representatives in Houston office.

▸ *CONTINENTAL AIR FILTERS, INC.*—Crawford Robertson, eastern division sales manager with headquarters in New York.

▸ *JAS. P. MARSH CORP.*—Lavaty Engineering Co., Chicago, exclusive factory distributor for the Chicago metropolitan area.

▸ *AUTOMATIC SWITCH CO.*—Mott Bros. Co., Rockford, Ill., authorized stocking distributors; Ralph B. Black, authorized sales representative for New Mexico and parts of west Texas.

▸ *DeLAVAL SEPARATOR CO.*—William Porch, manager of eastern division industrial sales with offices in New York.

▸ *BARNEBEY-CHENEY CO.*—R. M. Toucey, Pittsburgh; Harold O. Knape and Co., Dallas; L. R. Gorrell, Raleigh, N. C.; sales representatives.

▸ *REVERE COPPER AND BRASS, INC.*—G. John Gamber, manager—merchandise sales; Weston Jenkins, manager—industrial sales; John M. Walker, manager—aluminum sales; all in corporation's Michigan division, Detroit. Clyde A. Glenn, special executive representative; William C. Boon, assistant sales manager, interdivisional sales; Floyd M. Lasser and Frank M. Guenther, automotive representatives; Bernhard Stroh, industrial sales representative; all appointments for corporation's Michigan division.

▸ *CARRIER CORP.*—Power Engineering Corp., Vestal, N. Y. distributor for southern New York.

▸ *B-I-F INDUSTRIES, INC.*—Barret-Christie Co., Chicago agent for "Shuntflo" meter sales.

WHO'S WHAT

Continued

▸ *FAIRMONT ALUMINUM CO.*—David T. Applebee & Co., Grand Rapids, Mich., exclusive sales representative for major part of the state of Michigan; Aluminum Mill Sales Co. of New England, Melrose, Mass., exclusive sales representative for states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, most of Connecticut.

▸ *MUELLER BRASS CO.*—A. B. Oslin, district sales manager of south San Francisco sales office; Robert L. Gibbs, district sales manager of Pittsburgh sales office. Richard Grymonprez, sales representative in the Melrose Park, Ill., office; Wayne Boucher, sales representative in Philadelphia office; William Meil, sales representative in the Los Angeles office.

▸ *BALTIMORE AIRCOIL CO., INC.*—Donovan Associates, West Hartford, representative for Connecticut, western Massachusetts and Vermont; Engineered Equipment Co., Kansas City, Mo., representative for western Missouri and Kansas; R. M. Toucey, Pittsburgh, representative for western Pennsylvania.

▸ *NU-WAY CORP.*—Gunn & Pegelow, Chicago, representative in Illinois and northern Indiana; Frank N. Moran, Grosse Pointe, Mich., representative in Michigan and northwest Ohio; John A. Sandberg, Minneapolis, representative for Minnesota, Wisconsin, North and South Dakota; Arthur E. Olson, vice president, in charge of eastern territory.

▸ *RECOLD CORP.*—Floyd E. Fisher, representative in western Missouri, Arkansas and eastern Kansas; Robert K. Fleming, northwest district manager.

▸ *NATIONAL SUPPLY CO.*—John C. Madden, New York district manager for the company's *SPANG-CHALFANT DIV.*

▸ *AMERICAN AIR FILTER CO., INC.*—Richard Rhodes, supervising engineer in unit ventilator products department for midwest region.

▸ *McQUAY, INC.*—Louis Martin & Assoc., Columbus, Ohio, representative for West Virginia, Kentucky, Ohio and west Pennsylvania; William H. Webster, Jr., Norfolk, Va., representative for Virginia, North and South Carolina and Maryland; Stanley K. Grady, Abington, Pa., representative for eastern Pennsylvania, Delaware and the northern counties of Maryland; Walter B. Stamberger, Jr., northern New Jersey and New York.

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- **New material on ventilation of radioactive and high-toxicity contaminants.**
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- **New material on air cleaning for radioactive contaminants.**
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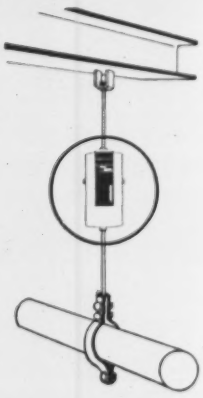
PIPE HANGERS

FOR

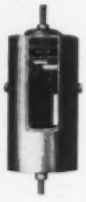
HEATING – PLUMBING
POWER & PROCESS



- Rugged
- Compact
- Simple in design and installation
- Indispensable for systems operating at changing temperatures

FIG. 401

SPRING HANGER



Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

WE HEAR THAT...

▸ *KENSICO TUBE CO.* celebrated its 10th anniversary on June 3. The production capacity of the company has grown from 100,000 to 1,000,000 lb per month in the past 10 years.

▸ *ARMCO STEEL CORP.*'s board chairman, *CHARLES R. HOOK*, received a special citation for his achievements in industrial management from the Indiana Technical College, Ft. Wayne.

▸ *CONTROLS CO. OF AMERICA* announced the acquisition of Redmond Co., Inc., Owosso, Mich., and Redmond Motors, Ltd., St. Thomas, Ont., through purchase of their inventories, tooling, patents and trademarks and the leasing of plants, equipment and other fixed assets.

▸ *ROBERTSHAW-FULTON CONTROLS CO.* opened a research and development center in Anaheim, Calif.

▸ *AIR REDUCTION SALES CO., div. of AIR REDUCTION CO., INC.* has dedicated a new facility for the production of liquid oxygen, nitrogen and argon at South Acton, Mass. The new plant will produce 75 tons of liquefied gases daily.

▸ *ROPER HYDRAULICS, INC.* has taken over the pump business of *GEO. D. ROPER CORP.*, pump division. The new corporation will utilize the same plant and facilities as the latter corporation.

▸ The first continuous process asbestos-cement pipe plant in the United States has been opened by *JOHNS-MANVILLE CORP.* at Denison, Tex.

▸ *RAMCO MFG. AND ENGINEERING CO.* has begun production of electrical heating units. The new company is located at 5413 N. E. Columbia Blvd., Portland, Ore.

▸ *HAYS MFG. CO.* is now occupying a recently acquired addition to its plant. The new quarters comprise 115,000 sq ft of factory and office space.

▸ *LOUIS ALLIS CO.* has opened facilities for delivery, application engineering and service in the southern California area at 4405 E. Olympic Blvd., Los Angeles.

WE HEAR THAT

Continued

▸ *HOOKER CHEMICAL CORP.* is the new name adopted by the former *HOOKER ELECTROCHEMICAL CO.* The new name is thought to more accurately represent the company's variety of products.

▸ Manufacturing facilities of the *FEDERAL BOILER CO's* Midland Park plant have been expanded.

▸ *MINE SAFETY APPLIANCES CO.* is expanding its field sales and service organization in the technical products division to provide national service.

▸ At the 70th annual meeting of the *MECHANICAL* (heating, piping and air conditioning) *CONTRACTORS' CHICAGO ASSOCIATION*, held at the Drake Hotel, *PAUL KROESCHELL* was re-elected president, *JAMES McCAULEY* was named vice president, *CHARLES CRONE* was re-elected treasurer and *SAMUEL L. HAAS* was chosen secretary. At the annual dinner following the meeting, to which the association invited a number of guests, an honorary membership was conferred on *ARNOLD GOELZ*, who has long been active in the association's apprenticeship work. *MARTIN J. WARD*, of Pipefitters Local 597, was presented a shotgun as a going away gift. Mr. Ward is leaving Chicago to become assistant secretary-treasurer of the UA in Washington. *FRANCIS X. McCARTIN* was subsequently elected to succeed him at Local 597.

▸ Open house was held for an estimated 1000 of *JOSEPH T. RYERSON & SON, INC.*'s customers and associates. The event took place on June 12 at the corporation's Indianapolis steel service plant.

▸ *WOLVERINE TUBE*'s mill depot has been moved to 1922 Ridge Ave., Evanston, Ill.

▸ A mobile laboratory from *TRION, INC.*, equipped with the latest devices for testing air filtering equipment, will begin a national tour, with visits planned to all major cities.

▸ *U. S. ELECTRICAL MOTORS INC.* celebrates its 50th anniversary this year with a series of events and announcements scheduled to last the entire year.

▸ *JOHN YELLOTT ASSOCIATES* has opened offices at 901 W. El Caminito, Phoenix, Ariz. The new firm has been formed to render consulting services in the field of mechanical engineering.

this WALKER SHUR-FLO Draft Inducer-Regulator Unit...

ENDS DRAFT PROBLEMS RIGHT FROM THE START...

MODELS For Gas... Oil... and Solid Fuels!

THE INSIDE STORY OF SHUR-FLO EFFICIENCY

- Hi Volume Self-Feathering Fan
- Self-Cleaning Blades (No soot build-up)
- Stainless Steel Shaft, Hub, and Blades.
- Quiet, burn-out proof motor
- Silicone oiled bearings
- Extra rigid mountings.
- Extra heavy gauge galv. steel construction.

"I don't fuss and fret with uncertain draft anymore since Walker brought out this low-priced draft inducer-regulator combination. Now, I install Walker inducers on all my jobs. That puts me way out ahead, because with good draft I know every job will be exactly right from the start."

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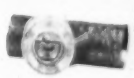

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WE HEAR THAT

Continued

▸ The second of two continuous weld pipe mills has been put into operation by *JONES & LAUGHLIN STEEL CORP.*'s Aliquippa, Pa., works.

▸ Operations of *BRUNNER CO.*, a subsidiary of *DUNHAM-BUSH, INC.*, have been moved from Gainesville, Ga., to the West Hartford, Conn., plant.

▸ *HOERBIGER CORP. OF AMERICA* has commenced operations at its new headquarters at 160 Van Brunt St., Brooklyn.

▸ *BREESE BURNERS, INC.*, a recent acquisition of *CONTROLS CO. OF AMERICA*, is transferring its sales and engineering office to the parent company's plant in Milwaukee.

▸ *AMERICAN BRASS CO.* officially opened the copper and copper alloy manufacturing facilities of its Los Angeles division on July 1.

▸ A new laboratory and testing center for hydronics research is being built by *SLANT-FIN RADIATOR CORP.* at Richmond Hill, N. Y.

▸ *CLYDE M. ALSTON* will be engaged in his own name as consulting engineer in heating, ventilating, air conditioning, piping and electrical engineering at Hempstead, L. I., N. Y.

▸ The sales headquarters of *REYNOLDS METALS CO.* has been moved from Louisville to Richmond, Va. All of the company's functions, including manufacturing, marketing, advertising, research and corporate groups, are now located in Richmond.

▸ *CHICAGO ASSOCIATION OF CONSULTING ENGINEERS* has awarded a life membership to *JOHN J. AEBERLY*, chief, Bureau of Heating, Ventilating, and Industrial Sanitation for the City of Chicago. Mr. Aeberly is known as the father of the Chicago ventilating code and has worked with all segments of the industry to develop the present code. This code has been recently rewritten and was made available late in 1957. It is becoming the basis for future revision of existing codes in many major cities. The code was published in full in the December 1957 issue of Heating, Piping & Air Conditioning.

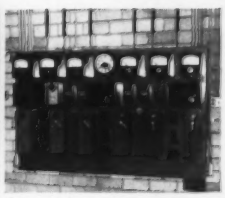
▸ *C. OSWALD PETERS*, a salesman for *EMBASSY STEEL PRODUCTS, INC.*, recently won a product naming contest at that company with the name "Red-E-Pak" for a new line of pre-assembled baseboard.

Coal *has always been dependable* now it can be automatic

Will - Burt Hopper and Bin Feed Model Stokers — capacities, 150 through 750 lbs. per hr.

A Will-Burt coal heat installation will *bring coal from bin to stoker . . . feed the necessary coal at any of three adjustable rates . . . and automatically adjust air supply minute by minute, to fuel bed needs.* Panel controls by Will-Burt will *automatically cycle one stoker, or several.*

What could be more practical — especially when you consider the known economy and safety of coal fired heat?



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MEETINGS & CONVENTIONS

1958

AUG. 18-20—*American Institute of Chemical Engineers* and *American Society of Mechanical Engineers*, national heat transfer conference. Edgewater Beach Hotel, Chicago. Information: L. T. Dupree, Exhibit Management, American Institute of Chemical Engineers, 25 W. 45th St., New York 36.

SEPT. 15-19—*Instrument Society of America*, instrument-automation conference and exhibit. Philadelphia Convention Hall, Philadelphia. Information: Fred J. Tabery, Exhibit Manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

OCT. 5-8—*National Association of Corrosion Engineers*, technical session. Hotel Somerset, Boston. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 12-15—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Broadmoor Hotel, Colorado Springs, Colo. Refrigeration and Air Conditioning Contractors Association, 10660 Carnegie Ave., Cleveland 6.

OCT. 13-15—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 13-15—*National Electronics Conference*, conference and exhibition. Hotel Sherman, Chicago. Information: Rudolph E. Hornacek, publicity committee chairman, c/o Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6.

OCT. 20-24—*46th National Safety Congress & Exposition*. Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 21-23—*National Association of Corrosion Engineers*, south central region conference. Roosevelt Hotel, New Orleans. NACE Headquarters: 1061 M & M Bldg., Houston 2.

OCT. 22-24—*Air-Conditioning and Refrigeration Wholesalers Association*, annual meeting. Sheraton-Palace Hotel, San Francisco. Information: 2607 N. High St., Columbus, Ohio.

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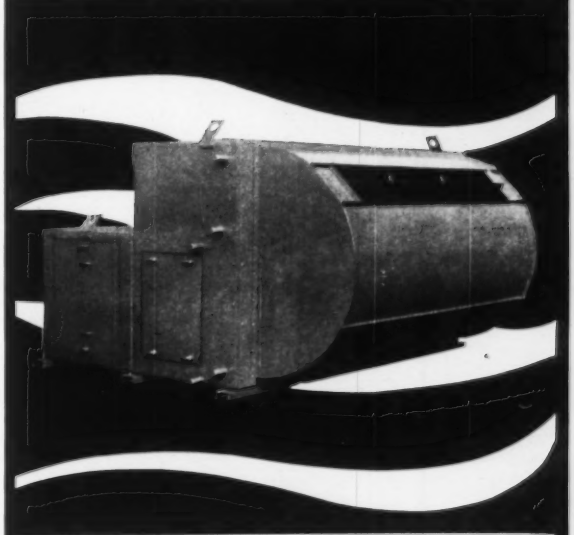

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Company.....

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City.....Zone.....State.....

MEETINGS & CONVENTIONS *Continued*

1958

NOV. 11-13—*National Association of Practical Refrigerating Engineers, Inc.*, annual meeting. Kenilworth Hotel, Miami Beach, Fla. National Association of Practical Refrigerating Engineers, Inc., 435 N. Waller Ave., Chicago 44.

NOV. 17-19—*National Association of Corrosion Engineers*, western region fall meeting. Statler Hotel, Los Angeles. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

NOV. 17-21—*Society of the Plastics Industry, Inc.*, eighth National Plastics Exposition. International Amphitheater, Chicago. To be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. SPI headquarters: 250 Park Ave., New York.

NOV. 18-20—*American Standards Association*, meeting. Roosevelt Hotel, New York. American Standards Association, 70 E. 45th St., New York.

DEC. 1-3—*American Society of Refrigerating Engineers*, semi-annual meeting. Roosevelt Hotel, New Orleans, La. American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1.

DEC. 1-4—*National Warm Air Heating and Air Conditioning Association*, annual convention. Cleveland, Ohio. Information: 640 Engineers Bldg., Cleveland 14.

DEC. 1-5—*American Society of Mechanical Engineers*, national exposition of power and mechanical engineering. New York Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17.

1959

JAN. 26-30—*14th International Heating and Air-Conditioning Exposition*. Philadelphia. Under auspices of the American Society of Heating and Air-Conditioning Engineers, in conjunction with its 65th annual meeting, also in Philadelphia. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.

JAN. 26-29—*Plant Maintenance and Engineering Show and Conference*. Cleveland Public Auditorium,

MEETINGS & CONVENTIONS — *Continued*

1959

Cleveland, Ohio. For information, contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 3-5—*Society of the Plastics Industry, Inc.*, 14th SPI reinforced plastics division conference. Edgewater Beach Hotel, Chicago. SPI headquarters: 250 Park Ave., New York 17.

MAR. 17-19—*National Association of Corrosion Engineers*, 1959 Corrosion Show and 15th annual conference. Sherman Hotel, Chicago. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

APRIL 1-3—*Gas Appliance Manufacturers Association*, annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

APRIL 29-*MAY* 1—*Oil-Heat Institute of America, Inc.*, annual convention. Seattle, Wash., Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36. ✠

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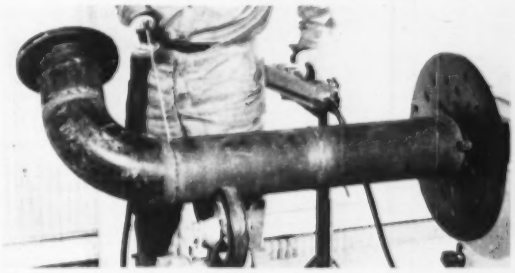

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TRANSACTIONS OF THE CONFERENCE ON THE USE OF SOLAR ENERGY . . . THE SCIENTIFIC BASIS—Vols. I-V. Edwin F. Carpenter, editor and A. Richard Kassander, Mary D. Bliss, associate editors. University of Arizona Press, Tucson, Ariz. $12.50 per set.

ASA B16.5-1957, STEEL PIPE FLANGES AND FLANGED FITTINGS—Revised Edition. American Standards Association, Dept. PR 1, 70 E. 45th St., New York 17. $3.00

THE AIR OVER LOUISVILLE—Summary of a Joint Report by the Special Air Pollution Study of Louisville and Jefferson County, Kentucky, 1956-1967. 57 pp. Robert A. Taft Sanitary Engineering Center, 4676 Columbia Pkwy., Cincinnati 26.

HEAT TRANSFER COEFFICIENTS FOR CONDENSING ORGANIC VAPORS OF PURE COMPONENTS AND BINARY MIXTURES—By Bernard S. Pressburg and James B. Todd. Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La. 35c.

ASA G37.1-1958, TENTATIVE SPECIFICATIONS FOR FORGED OR ROLLED ALLOY-STEEL PIPE FLANGES, FORGED FITTINGS, AND VALVES AND PARTS FOR HIGH-TEMPERATURE SERVICE. American Standards Association, Dept. PR 4, 70 E. 45th St., New York 17. 30c.

PROVED RESERVES OF CRUDE OIL, NATURAL GAS LIQUIDS AND NATURAL GAS—23 pp. American Gas Association, 420 Lexington Ave., New York 17; American Petroleum Institute, 50 W. 50th St., New York 20; Canadian Petroleum Institute, 330 Ninth Ave., W., Calgary, Alta.

ASA G16.1-1958, TENTATIVE SPECIFICATIONS FOR FORGED OR ROLLED STEEL PIPE FLANGES, FORGED FITTINGS, AND VALVES AND PARTS FOR GENERAL SERVICE. American Standards Association, Dept. PR 4, 70 E. 45th St., New York 17. 30c.

I-B-R BASEBOARD RATINGS—Approved under Third Edition I-B-R Baseboard Code. 41 pp. Institute of Boiler and Radiator Manufacturers 608 Fifth Ave., New York 20, N. Y.

1958 ROOM AIR-CONDITIONER RATING DATA—Reported by manufacturers to the Air-Conditioning and Refrigeration Institute. 19 pp. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

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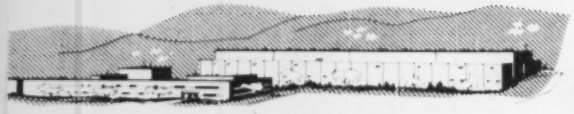
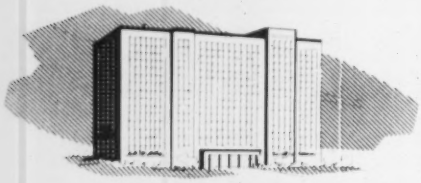
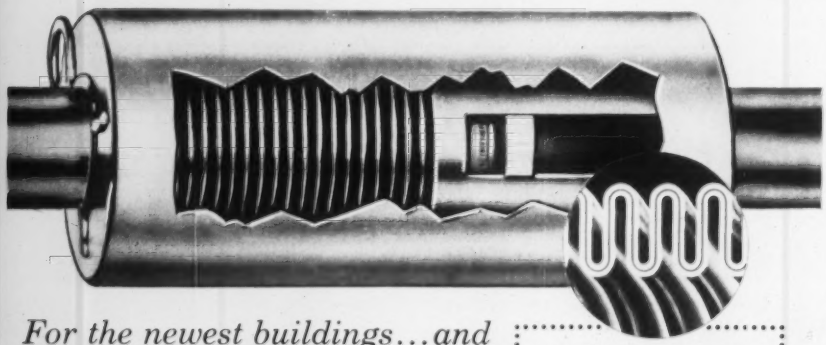


The Martin-Denver Company, Denver, Colorado



Stateway Gardens Apartments, Chicago, Illinois

Southwest Bell Telephone Company Kansas City, Missouri



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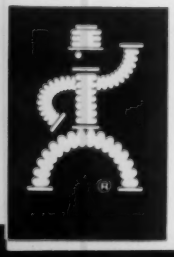

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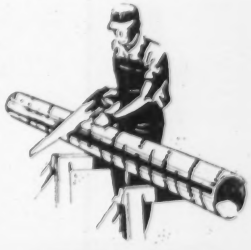

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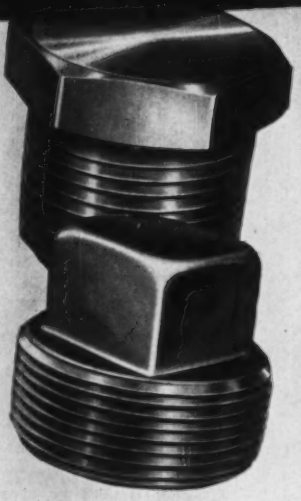

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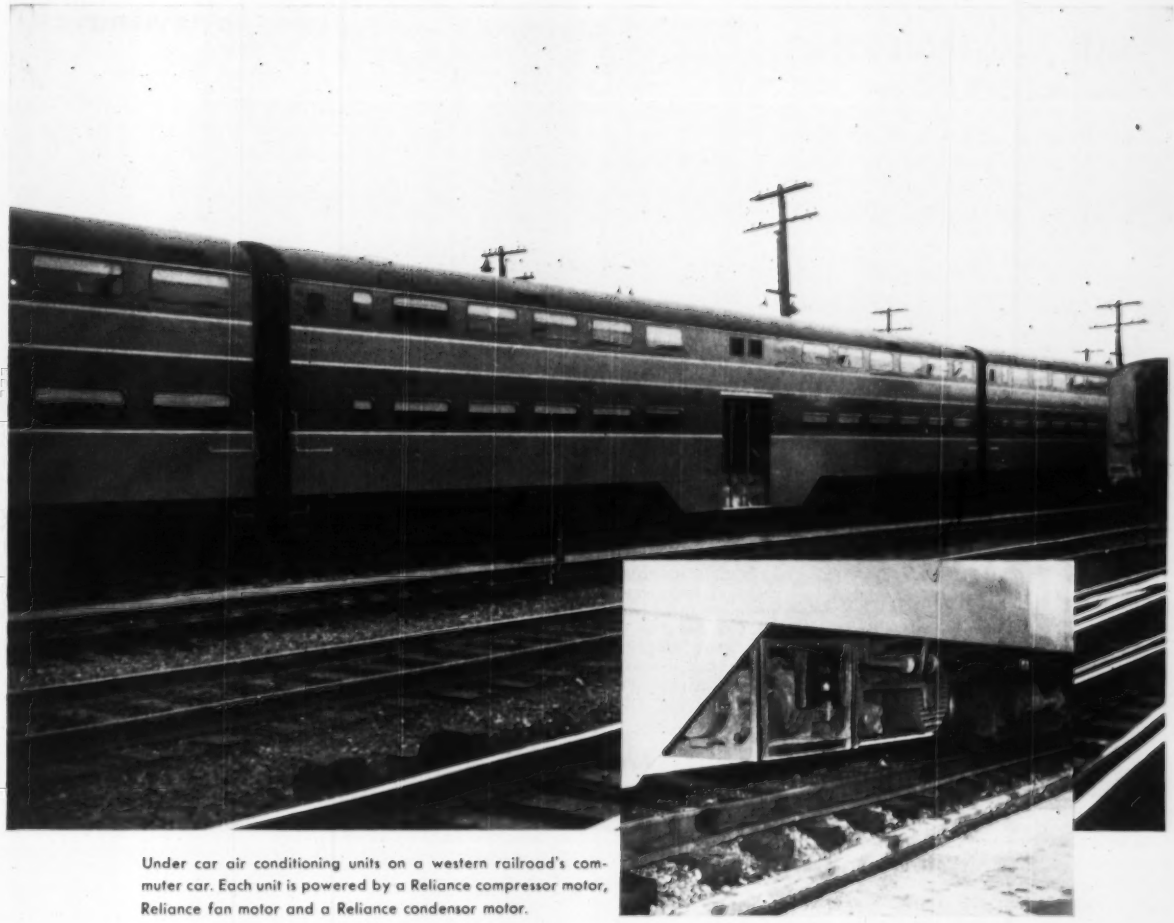

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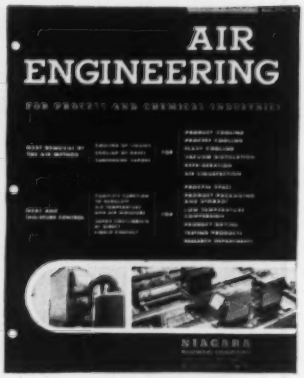

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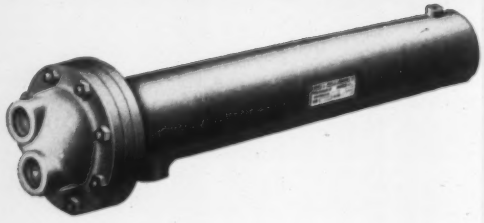

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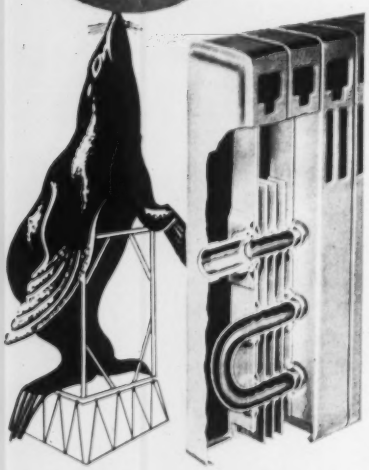

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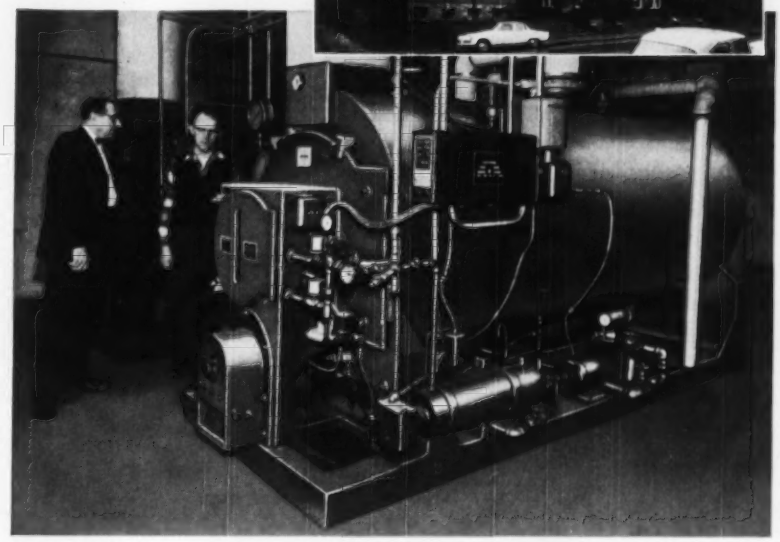

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Cleveland—P. M. Equipment Co.
Toledo—Air Conditioning Distributors, Inc.

OKLAHOMA
Oklahoma City—Mecha-Line Co.

PENNSYLVANIA
Phoenixville—Besco Sales, Merrill A. Squier
Pittsburgh—John C. Gregg Company

RHODE ISLAND
Providence—Weatherall Engineers, Inc.

TENNESSEE
Knoxville—Boiler Supply Co.
Memphis—Middle States Associates, Inc.
Nashville—Boiler Supply Company

TEXAS
Dallas—Rodgers Engineering Co., Inc.
Fort Worth—J. P. Philibert

UTAH
Salt Lake City—Power Engineering Company

VIRGINIA
Suffolk—C. Fred Bailey

WISCONSIN
Milwaukee—Industrial Steam, Inc.

CASE #100—Another case where General Electric Factory-Assembled Air Conditioning Units proved more economical than field-assembled systems.

Architect: Harold A. Berry, A.I.A., Donald H. Speck, Associate—General Contractor: James C. Stewart Co.

General Electric Ceiling-Mounted Units at the Dallas Home Furnishings Mart take no floor space—provide individual temperature control (heat and cool)—are metered for zone control of operating cost.

General Electric Zone-by-Zone Air Conditioning in Dallas Home Furnishings Mart permits

INDIVIDUAL CONTROL OF TEMPERATURE—ZONE CONTROL OF OPERATING COST

Air conditioning the vast new Dallas Home Furnishings Mart presented a 3-way challenge. (1) Over 400,000 sq. ft. to be air conditioned. (2) Provision had to be made for each exhibitor to control his own temperature and operating cost. (3) Floor space was at a premium. The ideal solution was found—in the Zone-by-Zone installation of General Electric Ceiling-Mounted Units.

The entire area gets heating and cooling from the same units. Each exhibit area has its own units *individually controlled and metered. No floor space is used.* No ductwork is required. Noise is held to whisper level. And when the Mart proved so successful that Mr. Trammell Crow, owner, decided to double its size, all that was necessary was to add individual units as individual showrooms were added. No fuss—no alterations—no interference with performance of existing units. This is a typical example of how General Electric *factory-assembled* units meet the most exacting air conditioning requirements.

General Electric's complete line is flexible enough to meet every air conditioning requirement for all buildings—large or small—old or new. Ceiling-mounted units water-cooled up to 7½ tons—air-cooled up to 10 tons. Floor-mounted units—water-cooled up to 30 tons—air-cooled up to 20 tons. Steam and hot water coils available for all models. It will pay you to discover how General Electric Factory-Assembled Units can simplify your planning. For full details write: General Electric Company, Commercial and Industrial Air Conditioning Dept., Bloomfield, N. J.

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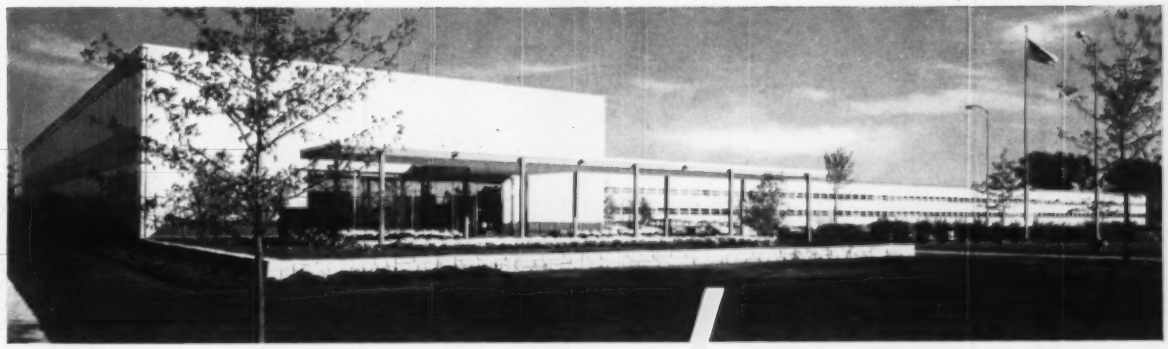
In Canada, Canadian General Electric Co., Ltd., Montreal



ARCHITECTS and ENGINEERS: Skidmore, Owings & Merrill
GENERAL CONTRACTORS: Chell and Anderson
HEATING and PROCESS PIPING: Wm. A. Pope Co.
AIR CONDITIONING and VENTILATION: Cicero Sheet Metal Co.

Efficient Manufacture Employee Well-being

both aided by Clarage "air" in new Avon cosmetics plant

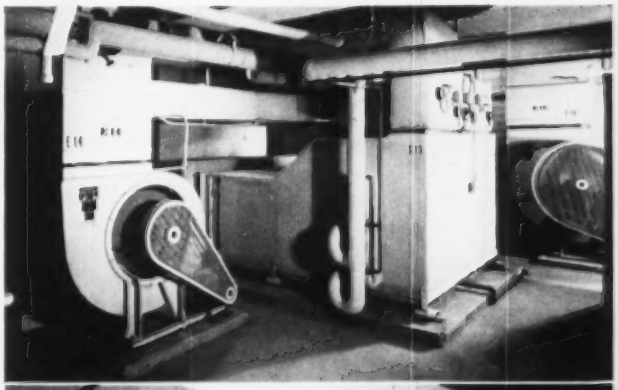
Here is much more than a thoroughly modern manufacturing facility. Here is a national sales center as well.

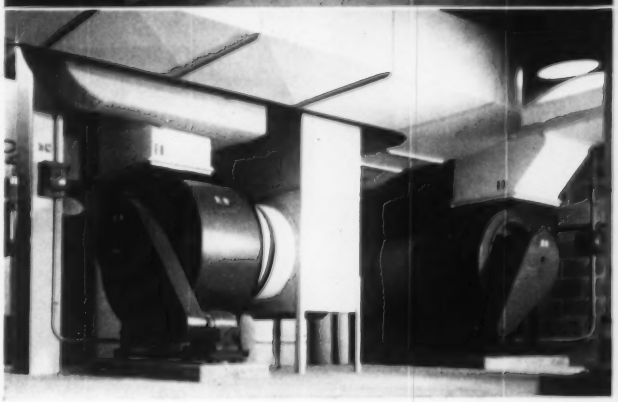
It's the new Avon Products, Inc., plant at Morton Grove, Illinois. From it flow the widely popular Avon cosmetic products. To it come members of Avon's door-to-door sales organization for training and sales meetings.

Air conditioning, thus, has a dual role to play in this structure — for employee comfort and for efficient manufacturing processes.

As for so many other noteworthy buildings, Clarage equipment was selected — some of which is shown on the right. On the job are Clarage Ready-Unit ventilating sets, system fans, and Multitherm air conditioning units, including the famous Blow-Thru units pioneered and perfected by Clarage for multi-zone service.

You, too, will find it profitable to specify Clarage for your next assignments — no matter how large, how small. CLARAGE FAN COMPANY, Kalamazoo, Michigan.





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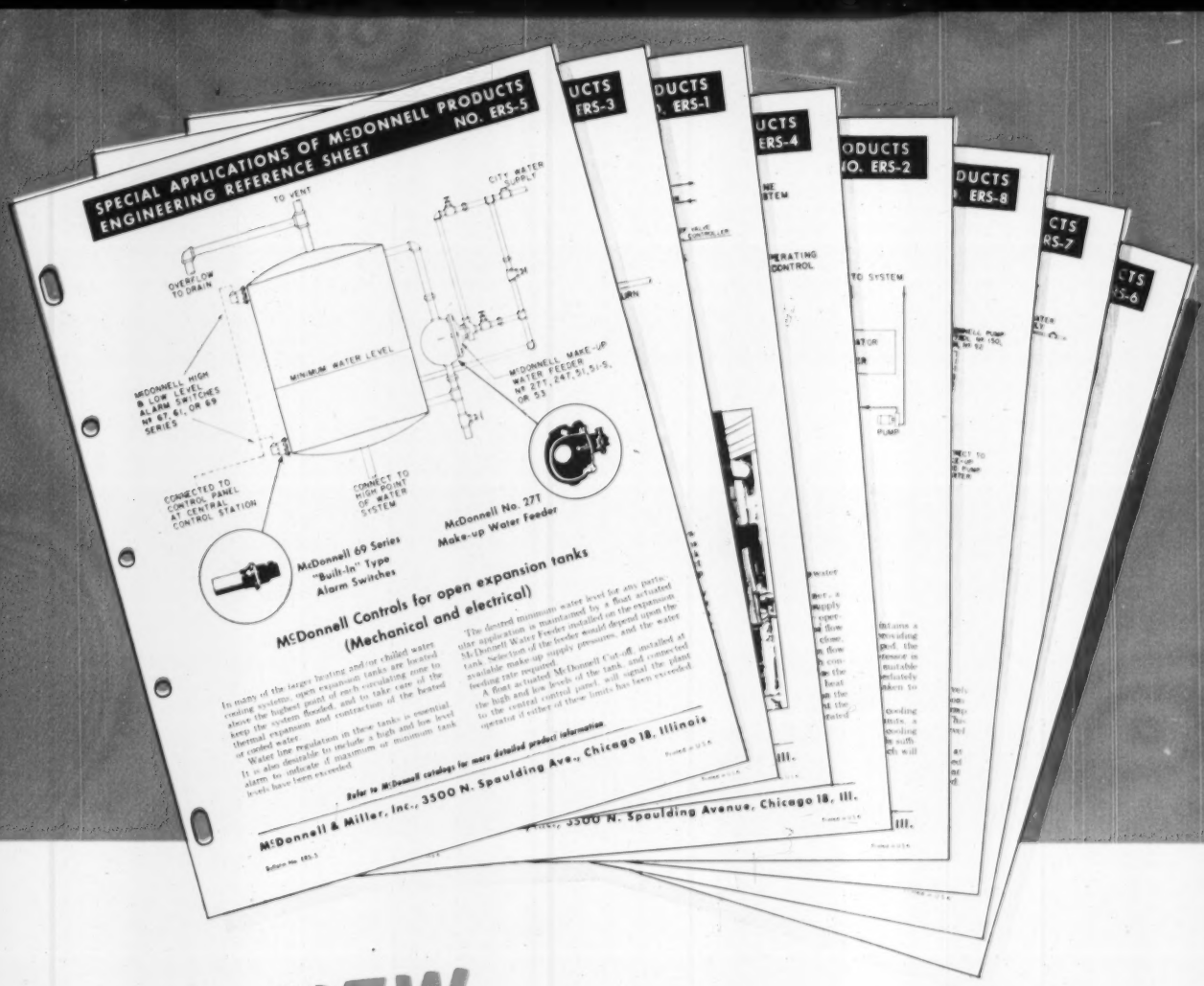
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To bring you up-to-date on such applications, McDonnell has published a series of engineering reference sheets. The simple diagrams and brief explanations will make it easy for you to take a lot of out-of-the-ordinary jobs in stride.

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